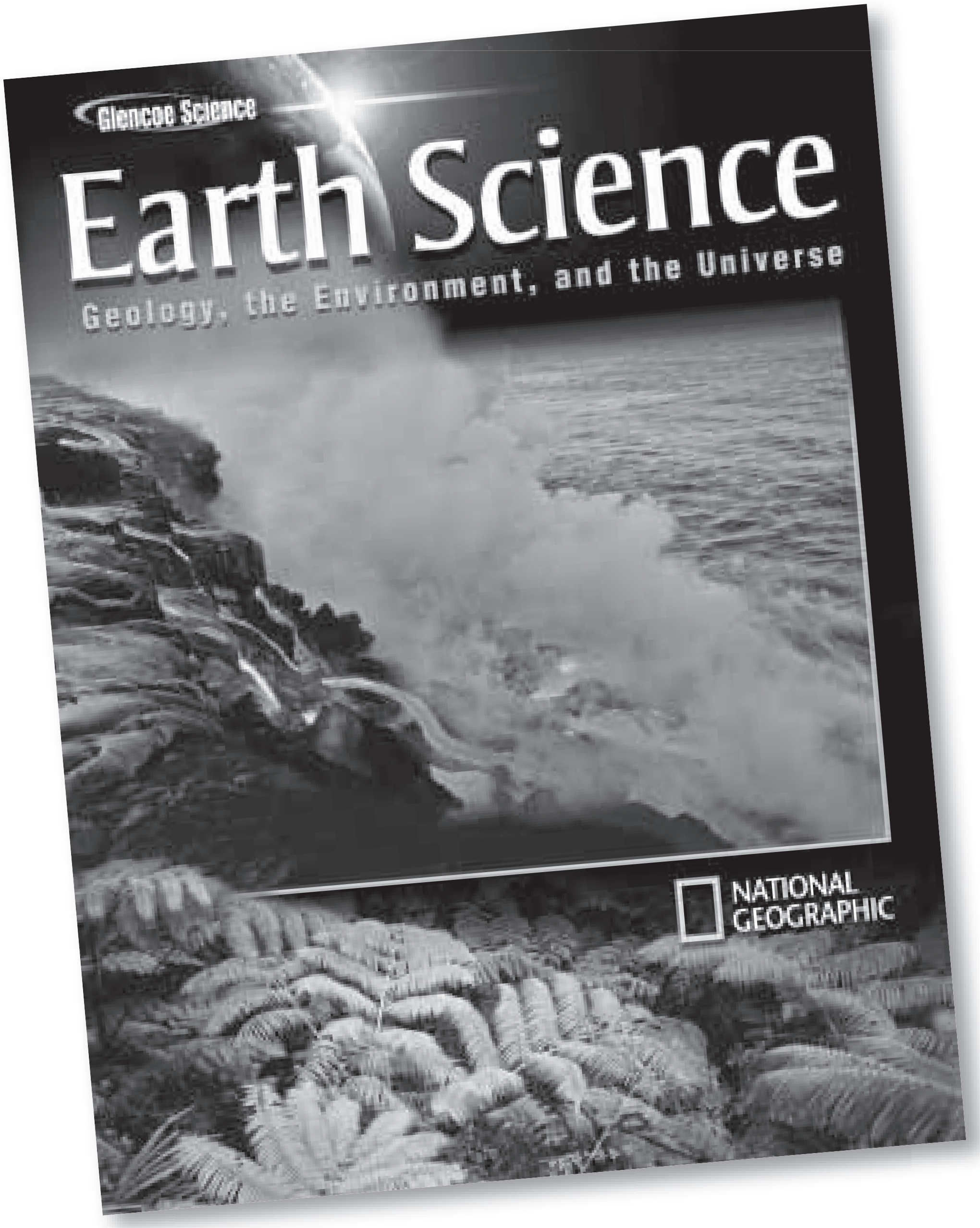
UNIT 5 RESOURCES

The Dynamic Earth



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New York, New York   Columbus, Ohio   Chicago, Illinois   Woodland Hills, California

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Send all inquiries to:
Glencoe/McGraw-Hill
8787 Orion Place
Columbus, OH 43240-4027

ISBN: 978-0-07-879212-0
MHID: 0-07-879212-6

Printed in the United States of America

1 2 3 4 5 6 7 8 9 10 009 11 10 09 08 07

Table of Contents

Teacher Approval Initials

Date of Approval

Lab Safety Form

Name: ____________________

Date: ____________________

Lab type (circle one) : Launch Lab, MiniLab, GeoLab

Lab Title: ____________________

Read carefully the entire lab and then answer the following questions. Your teacher must initial this form before you begin the lab.

1. What is the purpose of the investigation?

2. Will you be working with a partner or on a team? ____________________

3. Is this a design-your-own procedure? Circle: Yes No

4. Describe the safety procedures and additional warnings that you must follow as you perform this investigation.

5. Are there any steps in the procedure or lab safety symbols that you do not understand? Explain.

Table of Contents

Reproducible Pages

Chapter 17 Plate Tectonics

Name Class Date

MiniLab 17

Model Ocean-Basin Formation

How did a divergent boundary form the South Atlantic Ocean? Around 150 mya, a divergent boundary split an ancient continent. Over time, new crust was added along the boundary, widening the rift between Africa and South America.

Procedure

1. Read and complete the lab safety form.
2. Use a world map to create paper templates of South America and Africa.
3. Place the two continental templates in the center of a larger piece of paper and fit them together along their Atlantic coastlines.
4. Carefully trace around the templates with a pencil. Remove the templates and label the diagram *150 mya*.
5. Use an average spreading rate of 4 cm/y and a map scale of 1 cm = 500 km to create six maps that show the development of the Atlantic Ocean at 30-million-year intervals, beginning 150 mya.

Analyze and Conclude

1. **Compare** your last map with a world map. Is the actual width of the South Atlantic Ocean the same on both maps?

___

___

___

2. **Consider** why there might be differences between the width in your model and the actual width of the present South Atlantic Ocean.

___

___

Name Class Date

Mapping GeoLab

Model Plate Boundaries and Isochrons

Isochron maps of the ocean floor were first developed using data from oceanic rocks and sediment. Isochrons are imaginary lines on a map that show the parts of Earth's surface that are the same age. When geologists first analyzed isochron maps of the ocean floor, they discovered that Earth's crust is formed along ocean ridges and recycled at the edge of oceanic crust. This discovery led to the theory known as plate tectonics. Geologists continue using maps to study the motion of tectonic plates.

PREPARATION

Question:

Can you determine the age of the crust and type of plate boundaries?

Safety Precautions

Materials

paper
colored pencils
scissors
metric ruler
calculator

PROCEDURE

1. Read and complete the lab safety form.
2. ***Figure 1*** shows Plate B surrounded by Plate A. Trace the plates onto a separate sheet of paper and cut them out.
3. The arrow shows the movement of Plate B relative to Plate A. Move Plate A as shown in each part of ***Figure 1***.
4. Use the symbols shown in the legend to indicate the type of plate boundary and the relative motion across the boundary for each part of ***Figure 1***.
5. ***Figure 2*** shows two plates, A and B, separated by two ocean ridges and a transform boundary. Plates A and B are moving apart at 2 cm/y. Convert the speed 2 cm/y to km/y.
6. Trace ***Figure 2*** onto a separate sheet of paper. Assume the geometry of the boundaries in ***Figure 2*** has not changed over time. Draw isochrons on 10, 20, 30, and 40 million years.
7. Color the crust based on its age: 0-10 million years old–red, 10-20 million years old–yellow, 20-30 million years old–green, and 30-40 million years old–blue.

Name Class Date

Mapping GeoLab Model Plate Boundaries and Isochrons

Key

Use the following symbols to indicate the type of plate boundary:

- Divergent boundary
- Convergent boundary (triangles point to the plate that stays on the surface)
- Transform; arrows indicate the relative direction of motion across the boundary

Figure 1

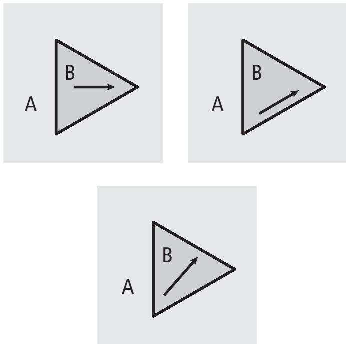
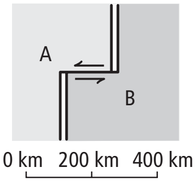
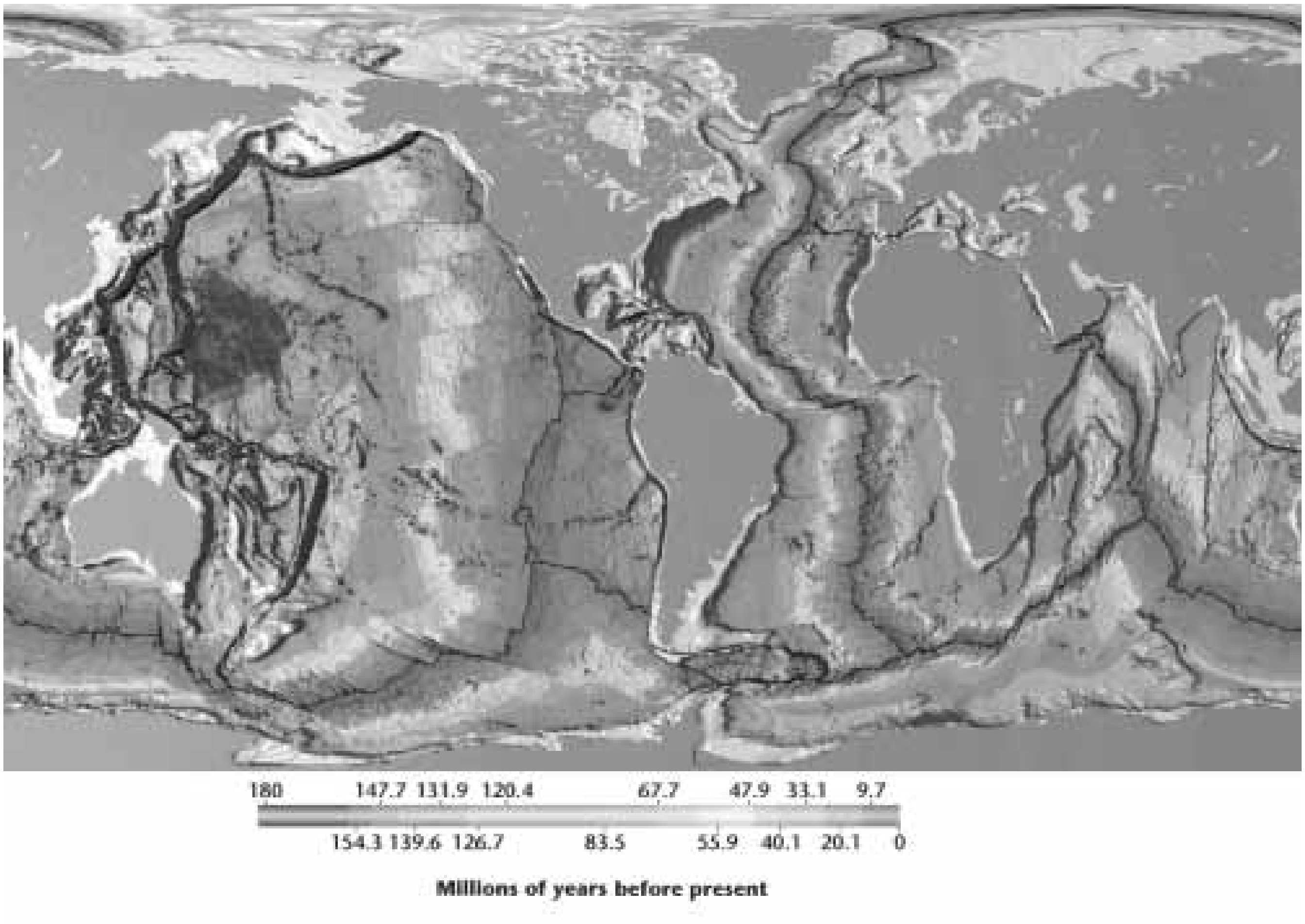


Figure 2





Name Class Date

Mapping GeoLab

Model Plate Boundaries and Isochrons

ANALYZE AND CONCLUDE

1. **Determine** the plate shape and motion that causes all the boundaries of the plate to be transform boundaries.

2. **Apply** from your map of isochrons, what is the easiest way to identify the location of transform boundaries?

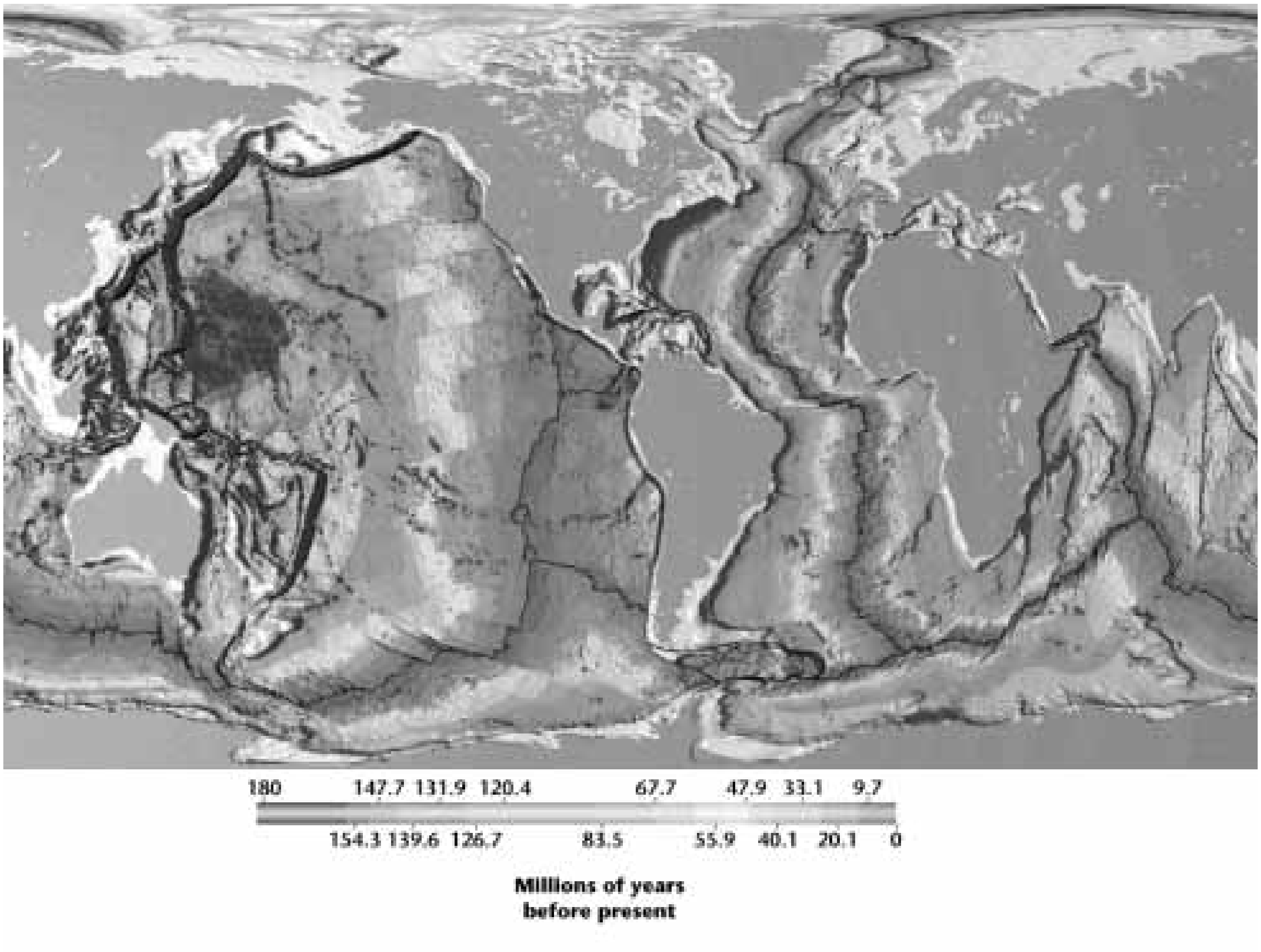
3. **Interpret** Look at **Figure 3.** From the pattern of the isochrons on the ocean floor, identify the divergent plate boundaries along the Atlantic, Ocean and along the Pacific Ocean.

4. **Differentiate** which ocean is marked by wider isochrons? based on the amount of oceanic crust produced in a given period of time, along which plate boundary is divergence happening more rapidly?

5. **Infer** the spreading center in the Pacific Ocean is not centered in the same manner as the Atlantic Ocean. Explain how this indicates the presence of convergent plate boundaries.

Use with Chapter 17
Section 17.2

Isochron Map of Ocean–Floor Crust



The thin black lines on the map show the location of ocean ridges.

Name Class Date

WORKSHEET 47 TEACHING TRANSPARENCY

Use with Chapter 17
Section 17.2

Isochron Map of Ocean–Floor Crust

1. What does each band of color on the seafloor represent?

2. How did researchers determine the ages of the seafloor crust?

3. What color is used to represent the youngest sections of seafloor? The oldest sections of seafloor?

4. The thin black lines on the map show the locations of ocean ridges. What pattern occurs in the bands of color on either side of ocean ridges?

5. How does the age of the crust change with distance from the ridge? Why?

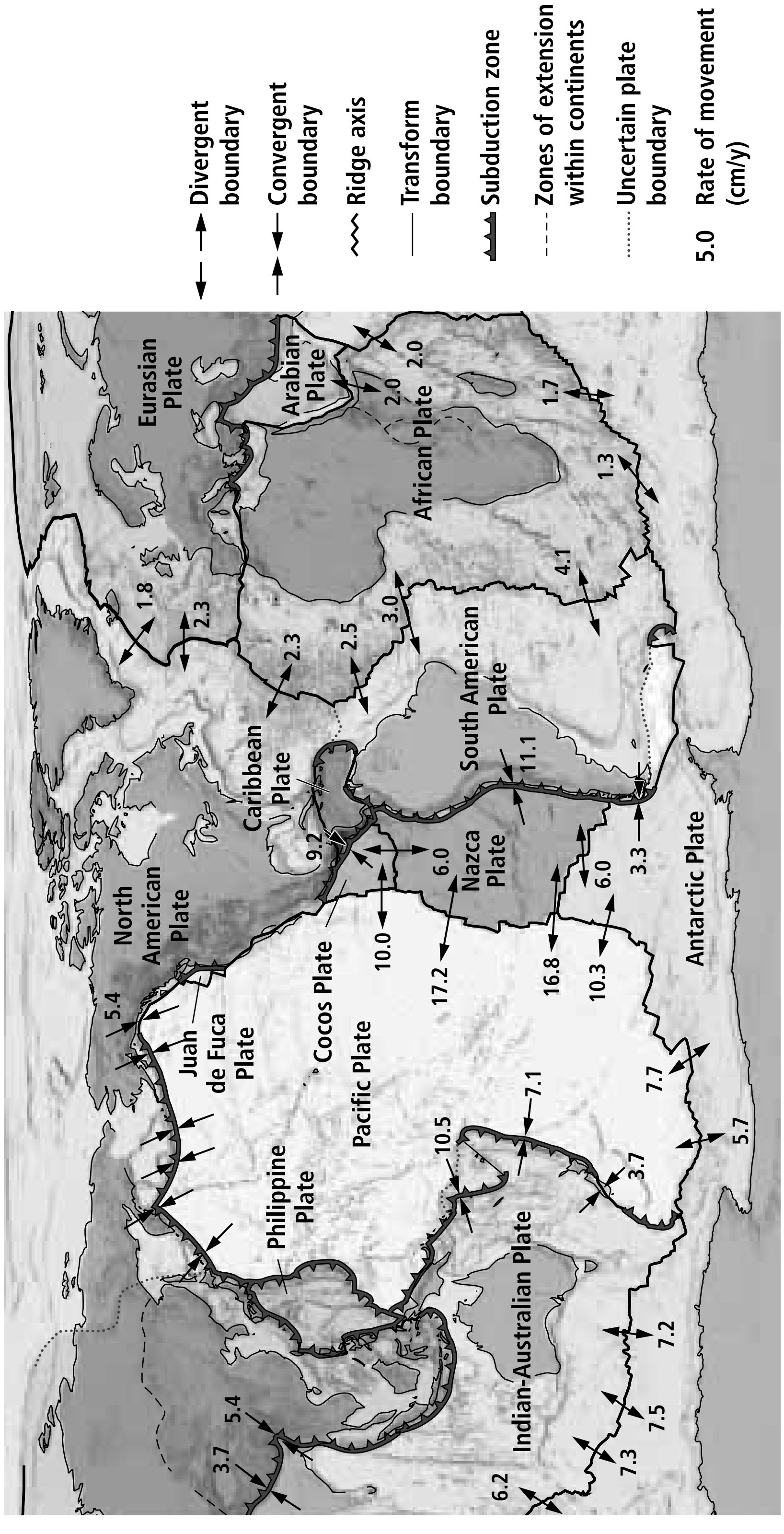
6. How do the widths of the color bands in the Pacific Ocean compare to the widths of the color bands in the Atlantic Ocean? What can you infer from this comparison about the rate of seafloor spreading?

7. What color is used to represent crust that is 100 million years old? 135 million years old?

8. How old is the ocean crust just off the east coast of the United States?

Use with Chapter 17
Section 17.3

Earth's Tectonic Plates



Name Class Date

WORKSHEET 48 TEACHING TRANSPARENCY

Use with Chapter 17
Section 17.3

Earth's Tectonic Plates

1. In what direction is the Pacific Plate moving?

2. Are the Pacific Plate and the Antarctic Plate moving toward each other, away from each other, or past each other? Explain your answer.

3. What type of boundary separates the South American Plate from the Nazca Plate? Explain your answer.

4. Describe the relative motion between the North American Plate and the Pacific Plate.

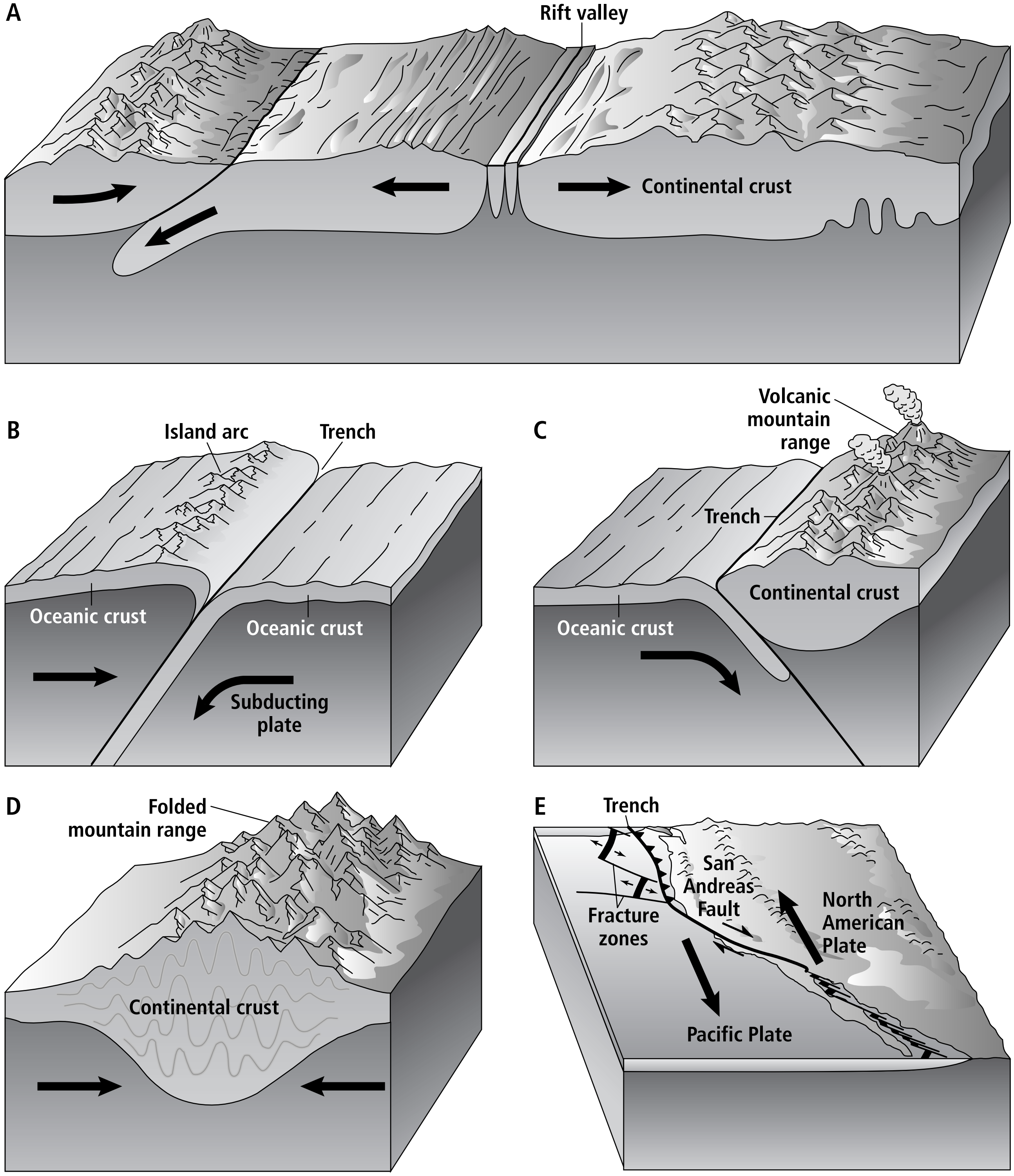
5. Between which plates is the relative motion the fastest?

6. Would you predict that, over time, the distance between New York and Miami will increase, decrease, or stay the same? Explain your answer.

7. Would you predict that, over time, the distance between New York and Lisbon, a city in southern Europe, will increase, decrease, or stay the same? Explain your answer.

Use with Chapter 17
Section 17.3

Types of Plate Boundaries



Name Class Date

WORKSHEET 49 TEACHING TRANSPARENCY

Use with Chapter 17
Section 17.3

Types of Plate Boundaries

1. Which diagram shows a divergent boundary? How do the plates move relative to each other at this type of boundary?

2. At a divergent boundary, what feature forms when two oceanic plates are involved? When two continental plates are involved?

3. Which diagram shows oceanic-oceanic convergence? Describe what occurs at this type of plate boundary.

4. The Himalayas are mountains that are forming as a result of the collision of the Indian and Eurasian continental plates. Which diagram shows a plate boundary like the one involved in the formation of these mountains?

5. Which diagram shows oceanic-continental convergence? Describe what occurs at this type of plate boundary.

6. Which diagram shows a transform boundary? Describe what occurs at this type of plate boundary.

Name Class Date

CHAPTER 17 STUDY GUIDE

Plate Tectonics

SECTION 17.1 *Drifting Continents*

In your textbook, read about continental drift.
Circle the letter of the choice that best completes each statement.

1. Early mapmakers thought continents might have moved based on their observations of
a. magnetism.
b. rock and fossil evidence.
c. matching coastlines.
d. earthquakes and floods.

2. Pangaea was an ancient supercontinent made up of
a. South Africa, India, Australia, and South America.
b. the United States, Greenland, and Europe.
c. Antarctica, India, and South America.
d. all of Earth's continents.

3. To support his hypothesis of continental drift, Alfred Wegener did NOT use
a. ancient climatic evidence.
b. magnetic field data.
c. data on ancient reptiles and ferns.
d. evidence from rock formations.

4. Fossil evidence that supported Wegener's idea of continental drift included
a. land-dwelling animals.
b. ocean plants.
c. ocean mammals.
d. tropical flowers.

5. Fossils of aquatic reptiles found in freshwater rocks suggested to Wegener that these reptiles
a. swam the great distances between continents.
b. probably did not cross the oceans.
c. ate *Glossopteris*.
d. once lived in Earth's oceans.

6. Based on observations of fossils of *Glossopteris*, Wegener concluded that
a. magnetic reversals had occurred in Earth's past.
b. continental rocks containing these fossils had once been joined.
c. Earth's continents were never joined.
d. *Glossopteris* grew only in the tropics.

7. Coal beds in Antarctica indicated to Wegener that this continent was
a. always cold.
b. inhabited by penguins.
c. once located closer to the equator.
d. once beneath the ocean.

8. Based on the glacial deposits he observed, Wegener argued that
a. glaciers form near the equator.
b. Earth's axis of rotation had changed in the past.
c. landmasses drifted away from the south pole.
d. *Glossopteris* could not survive hot weather.

9. Most scientists at the time rejected Wegener's hypothesis of continental drift because he
a. had collected little evidence to support his hypothesis.
b. would not state his hypothesis publicly.
c. insisted that Earth's axis of rotation had changed.
d. couldn't explain how or why the continents moved.

SECTION 17.2 *Seafloor Spreading*

In your textbook, read about seafloor spreading.

In the space at the left, write *true* if the statement is true; if the statement is false, change the italicized word or phrase to make the statement true.

______ **1.** *Sonar* uses sound waves to measure water depth.

______ **2.** Maps made from sonar and magnetometer data led to the discovery of *ocean ridges and deep-sea trenches*.

______ **3.** *Deep-sea trenches* are vast, underwater mountain chains.

______ **4.** Rock samples taken near ocean ridges are *older* than rock samples taken near deep-sea trenches.

______ **5.** The thickness of ocean-floor sediments *decreases* with distance from an ocean ridge.

______ **6.** The oldest ocean floor rocks are about *3.8 billion* years old.

______ **7.** The study of the magnetic record preserved in Earth's rocks is called *paleomagnetism*.

______ **8.** *An isochron* is a change in Earth's magnetic field.

______ **9.** Earthquake activity and volcanism are common along *ocean ridges*.

______ **10.** The magnetic patterns on either side of *a deep-sea trench* are mirror images of each other.

______ **11.** The theory of *continental drift* states that new ocean crust is formed at ocean ridges and destroyed at deep-sea trenches.

______ **12.** As new seafloor is carried away from an ocean ridge, it *heats up, expands, and becomes less dense* than the material beneath it.

______ **13.** The theory of seafloor spreading explains that Earth's continents move because they *ride atop ocean crust as it moves away from ocean ridges*.

The statements below describe the steps involved in the process of seafloor spreading. Number these steps in the order in which they occur.

______ **14.** Magma fills the gap that is created.

______ **15.** Magma hardens to form new ocean crust.

______ **16.** Magma is forced upward toward the crust.

SECTION 17.2 *Seafloor Spreading, continued*

In your textbook, read about magnetism.
Use each of the terms below just once to complete the passage.

isochron	**magnetic field**	**normal polarity**
older	**reversed polarity**	**younger**

Earth's **(17)** ____________________ has changed over time. A field with the same orientation as today's field is said to have **(18)** ____________________. A field that is opposite the present field has **(19)** ____________________. Magnetometers have been used to measure the ocean floor's magnetic field. Magnetic data of the ocean floor has been used to generate **(20)** ____________________ maps, which have shown that the ocean floor is **(21)** ____________________ near ocean ridges and **(22)** ____________________ near deep-sea trenches.

In your textbook, read about ocean rocks and sediments, magnetism, and seafloor spreading.
For each item in Column A, write the letter of the matching item in Column B.

	Column A	Column B
______	**23.** Device that can detect small changes in magnetic fields	**a.** isochron
______	**24.** Minerals containing this act like small compass needles and record the orientation of Earth's magnetic field at the time of their formation	**b.** iron
______	**25.** Was constructed from data gathered from continental basalt flows	**c.** geomagnetic time scale
______	**26.** This type of line connects points on a map that have the same age	**d.** new ocean crust
______	**27.** Each cycle of spreading and magma intrusion along an ocean ridge results in the formation of this	**e.** magnetometer

SECTION 17.3 *Theory of Plate Tectonics*

In your textbook, read about plate tectonics and plate boundaries.

Circle the letter of the choice that best completes the statement or answers the question.

1. Which theory states that Earth's crust and rigid upper mantle move in different directions and at different rates over Earth's surface?

a. ridge push and slab pull
b. seafloor spreading
c. continental drift
d. plate tectonics

2. Tectonic plates interact at places called plate

a. reversals.
b. boundaries.
c. regions.
d. subductions.

3. Places where tectonic plates move apart are called

a. convergent boundaries.
b. transform boundaries.
c. subduction zones.
d. divergent boundaries.

4. Where are most divergent boundaries found?

a. on the seafloor
b. on continents
c. along coastlines
d. at subduction zones

5. What happens along a divergent boundary?

a. Continental mountain ranges form.
b. New ocean crust forms.
c. Oceanic plates are subducted into the mantle.
d. Ocean basins become smaller.

6. The Mid-Atlantic Ridge is an example of a

a. divergent boundary.
b. convergent boundary.
c. subduction zone.
d. transform boundary.

7. Places where tectonic plates come together are called

a. convergent boundaries.
b. divergent boundaries.
c. transform boundaries.
d. rift valleys.

8. Convergent boundaries are classified according to the

a. types of fossils found at the boundaries.
b. rate at which the plates collide.
c. compass direction of movement of the plates.
d. type of crust involved.

SECTION 17.3 *Theory of Plate Tectonics, continued*

9. Oceanic crust is made mostly of
- **a.** granite.
- **b.** basalt.
- **c.** water.
- **d.** sediments.

10. Which of the following features forms when two oceanic plates converge?
- **a.** magnetic reversal patterns
- **b.** divergent boundaries
- **c.** subduction zones
- **d.** rift valleys

11. What can happen when two oceanic plates converge and one is subducted into the mantle?
- **a.** Melted magma erupts and forms an arc of islands.
- **b.** The colliding plate edges become crumpled to form a mountain range.
- **c.** The lithosphere splits to create a divergent plate boundary on land.
- **d.** A continent splits to form a new ocean basin.

12. Which of the following landforms results from divergence of continental crust?
- **a.** a mountain range
- **b.** a rift valley
- **c.** a deep-sea trench
- **d.** a long fault

13. Which of the following best describes what happens when an oceanic plate converges with a continental plate?
- **a.** A deep-sea trench and an island arc form.
- **b.** Both plates become fractured, and a series of long faults form on the surface.
- **c.** Both plates crumple and a folded mountain range forms.
- **d.** A trench and a mountain range with many volcanoes form.

14. Which feature is associated with a continental-continental plate boundary?
- **a.** a subduction zone
- **b.** a mountain range
- **c.** a deep-sea trench
- **d.** a volcano

15. At which tectonic plate boundary do plates slide horizontally past each other?
- **a.** transform boundary
- **b.** divergent boundary
- **c.** continental-continental boundary
- **d.** oceanic-oceanic boundary

16. Which of the following is NOT associated with transform boundaries?
- **a.** deformed and fractured crust
- **b.** shallow earthquakes
- **c.** long faults
- **d.** volcanoes

SECTION 17.4 *Causes of Plate Motion*

In your textbook, read about mantle convection, ridge push, and slab pull.
Answer the following questions.

1. Explain the process of convection.

2. Describe the formation of convection currents in the mantle.

3. Explain how the parts of a convection current in the mantle are related to plate motions.

4. Compare and contrast ridge push and slab pull.

Table of Contents

Reproducible Pages

Chapter 18 Volcanism

Name Class Date

MiniLab 18

Model a Caldera

How do calderas form? Calderas are volcanic craters that form when the summit or the side of a volcano collapses into the magma chamber that once fueled the volcano.

Procedure

1. Read and complete the lab safety form.
2. Obtain a small box, a 10-cm length of rubber tubing, a clamp and a balloon from your teacher.
3. Line the box with newspaper and make a small hole in the box and the newspaper with scissors.
4. Thread the neck of the balloon through the hole, insert the rubber tubing into the neck, securing it with tape, inflate the balloon by blowing through the tubing, and use the clamp to close the tubing.
5. Pour six cups of flour over the balloon.
6. Sculpt the flour into the shape of a volcano. You might need to vary the amount of flour and type of box to reach the desired effect.
7. Remove the clamp, releasing the air from the balloon. Observe your caldera forming, and record your observations
8. Compare your caldera to your classmates'.

Analyze and Conclude

1. **Sequence** the formation of the caldera.

___

___

___

2. **Compare** the features of a caldera with those of a crater.

___

___

___

3. **Infer** how the caldera will form if you vary how much you inflate the balloon.

___

___

___

Internet GeoLab

Predict the Safety of a Volcano

Some volcanoes are explosively dangerous. Along with clouds of ash and other volcanic debris, pyroclastic flows, landslides, and mudflows are common volcanic hazards. However, an explosive volcano might not be a hazard to human life and property if it is located in a remote area or if it erupts infrequently.

PREPARATION

Question

What factors should be considered when evaluating a volcano?

Hypothesis

Form a hypothesis about where you think the most hazardous volcanoes are located on Earth. Think about the potential risk to people and property near the volcano when formulating your hypothesis. Write your hypothesis in the space below.

___

___

___

Objectives

In this GeoLab, you will:

- **Gather** and **communicate** data about three volcanoes in different parts of the world.
- **Form conclusions** about the hazards posed by the volcanoes based on their location, size, lava type, and eruptive history.

Materials

Internet access to glencoe.com or volcano data provided by your teacher current reference books with additional volcano data markers or colored pencils.

PROCEDURE

Imagine that you work for the United States Geological Survey (USGS) and are asked to evaluate several volcanoes around the world. Your job is to determine if the volcanoes are safe for the nearby inhabitants. If the volcanoes are not safe, you must make recommendations to ensure the safety of the people around them.

1. Read and complete the lab safety form.
2. Form a team of three to four scientists.
3. Within your team, brainstorm some factors you might use to evaluate the volcanoes. Record your ideas. You might include factors such as eruption interval, composition of lava, approximate number of people living near the volcano, and the date of the last known eruption.
4. With your group, decide which factors you will include.
5. Use the factors you have chosen to create a data table. Make sure your teacher approves your table and your factors before you proceed.
6. Visit glencoe.com (or use the information your teacher provides) and select a country where there is a known volcano.
7. Complete your data table for your first country. Repeat Step 6 for at least two more countries.
8. Repeat Steps 6 and 7 for two more countries.

Internet GeoLab

Predict the Safety of a Volcano

Data Table

	United States	Country 2	Country 3
Volcano name	Mount St. Helens		
Date of last known major eruption	May 1980		
Volcano height	2,549 m		
Age of rock	<40,000 years		
Dome diameter	3500 ft		
Lava composition	Andesitic, basaltic		
Type of eruption	Explosive		
Type of volcano	composite		

	Country 4	Country 5	Country 6
Volcano name			
Date of last known major eruption			
Volcano height			
Age of rock			
Dome diameter			
Lava composition			
Type of eruption			
Type of volcano			

Name Class Date

Internet GeoLab

Predict the Safety of a Volcano

ANALYZE AND CONCLUDE

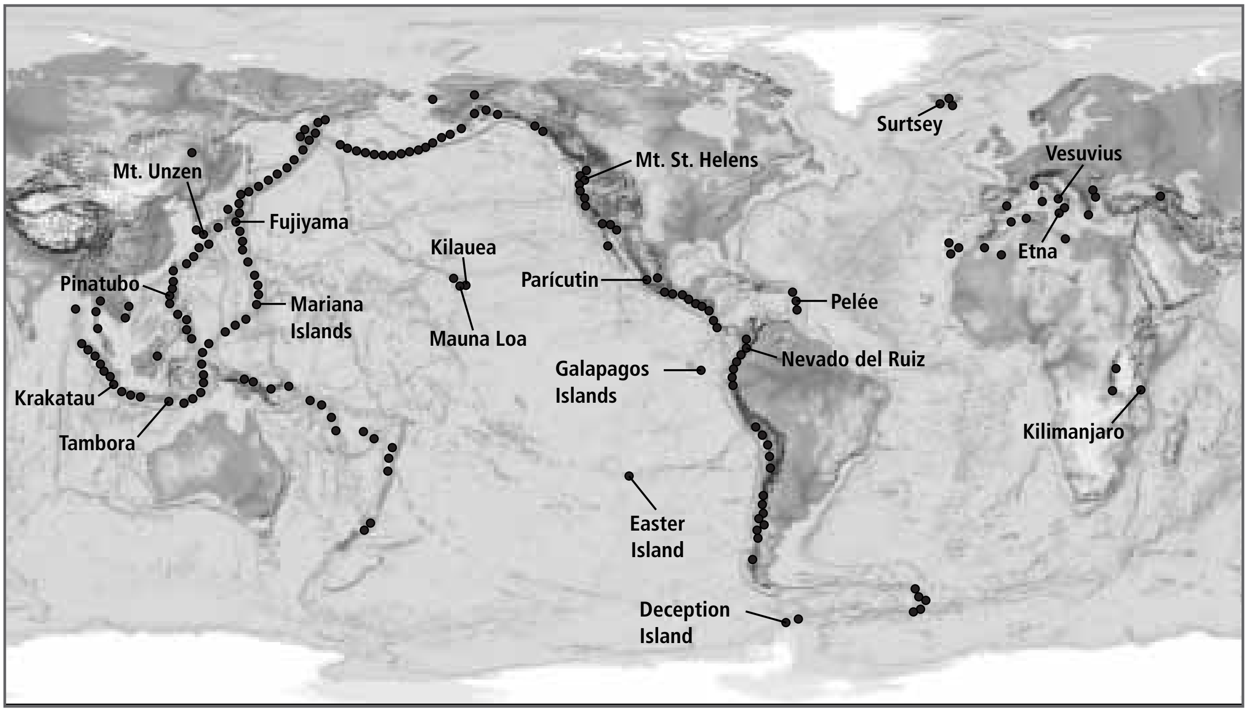
1. **Interpret Data** Is it safe for people to live close to any of the volcanoes? Why or why not?

2. **Interpret Data** Do any of the volcanoes pose an immediate threat to the people who might live nearby? Why or why not?

3. **Conclude** Prepare to present your findings to a group of scientists from around the world. Be sure to include your predictions and recommendations, and be prepared for questions. Display your data table to help communicate your findings.

Use with Chapter 18
Section 18.1

Some Active Volcanoes of the World



Name Class Date

WORKSHEET 50 TEACHING TRANSPARENCY

Use with Chapter 18
Section 18.1

Some Active Volcanoes of the World

1. Name two active volcanoes in the Atlantic Ocean.

2. How do the numbers of active volcanoes in the Pacific Ocean and Atlantic Ocean compare?

3. Where in North America and South America are most active volcanoes located?

4. Describe the pattern of volcanoes located in and around the Pacific Ocean.

5. What active volcano occurs south of South America?

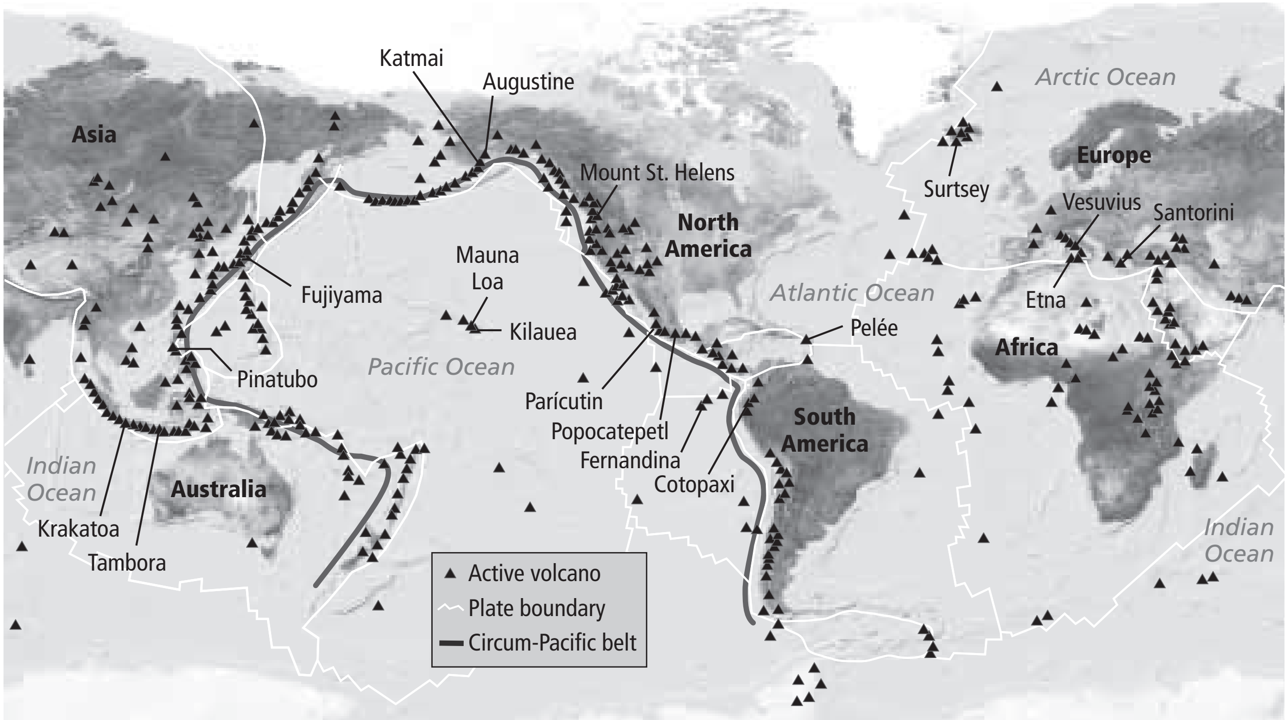
6. Where in Africa are most active volcanoes located?

7. Where is Vesuvius located?

8. Which continent has no active volcanoes?

Use with Chapter 18
Section 18.3

Volcanic Belts



Name Class Date

WORKSHEET 51 TEACHING TRANSPARENCY

Use with Chapter 18
Section 18.1

Volcanic Belts

1. How is the Circum-Pacific Belt represented on the map?

____

____

2. How is the Mediterranean Belt represented?

____

____

3. Which volcanic belt borders the western coasts of North America and South America?

____

____

4. To which volcanic belt do the Aleutian Islands belong?

____

____

5. Within which volcanic belt is Vesuvius?

____

____

6. Within which volcanic belt is Fujiyama?

____

____

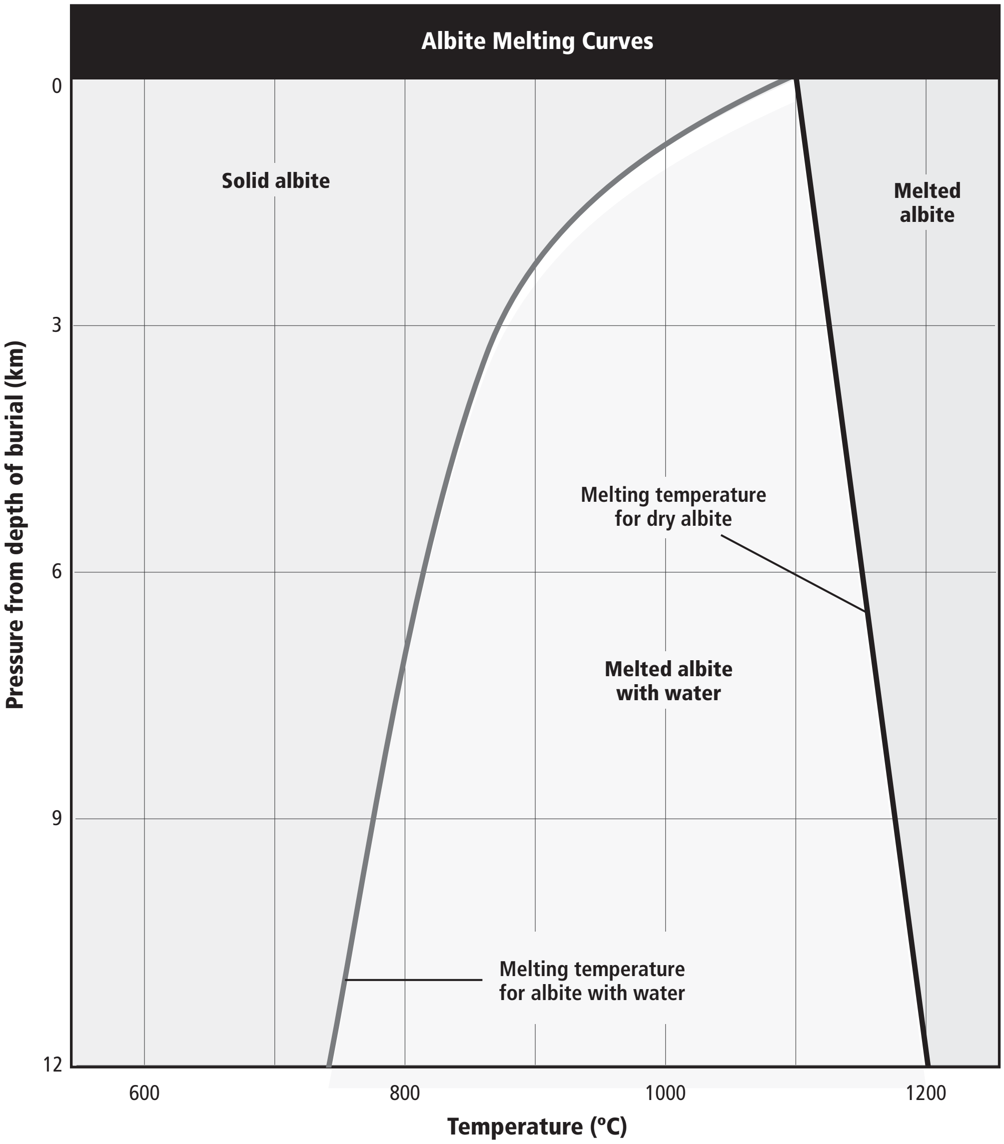
7. Make a generalization about where most volcanoes occur.

____

____

Use with Chapter 18
Section 18.2

Albite Melting Curves



Use with Chapter 18
Section 18.2

Albite Melting Curves

1. What information is given in the graph?

2. What information is plotted on the horizontal axis of the graph? What is the range of possible values?

3. What information is plotted on the vertical axes of the graph? What is the range of possible values?

4. Which part of the graph represents conditions at Earth's surface?

5. How does pressure change with depth?

6. At a depth of 6 km, at what temperature does wet albite melt? Dry albite?

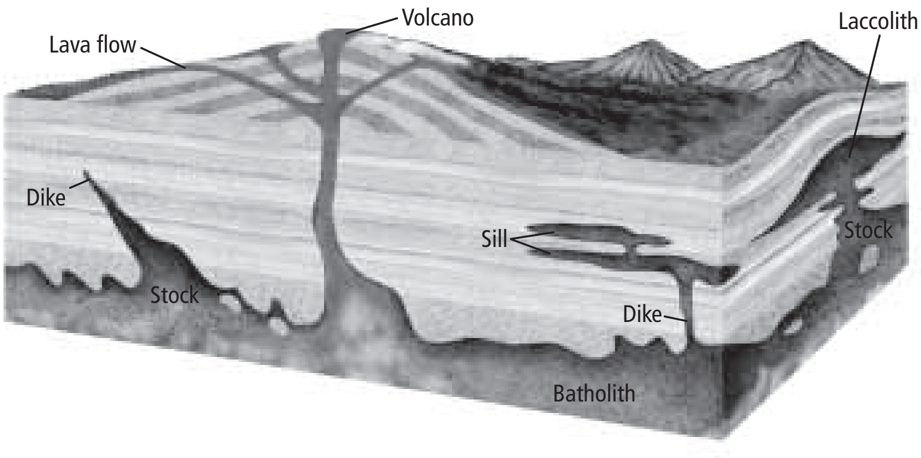
7. What generalization can you make about the temperature at which wet albite melts and distance from Earth's surface?

8. What generalization can you make about the temperature at which dry albite melts and distance from Earth's surface?

9. At a pressure of 400 MPa, how do the melting temperatures of wet and dry albite compare?

Use with Chapter 18
Section 18.3

Igneous Activity



Name Class Date

WORKSHEET 53 TEACHING TRANSPARENCY

Use with Chapter 18
Section 18.3

Igneous Activity

1. What is a pluton? How many different kinds of plutons are shown in the diagram?

2. Into which intrusive bodies have broken blocks of the intruded rock sunk?

3. How does magma move from a chamber deep within Earth to Earth's surface?

4. What is a mushroom-shaped pluton with a round top and flat bottom called?

5. How do batholiths and stocks compare?

6. What are sills and how do they form?

7. What type of thin pluton cuts across existing layers of rock?

8. How do dikes form?

Volcanism

SECTION 18.1 *Volcanoes*

In your textbook, read about the anatomy of a volcano and volcanic material.
Circle the letter of the choice that best completes the statement or answers the question.

1. Lava erupts through an opening in Earth's crust called a
a. vent. **b.** crater. **c.** caldera. **d.** volcano.

2. A bowl-shaped depression that forms around the vent of a volcano is a
a. magma chamber. **b.** vent. **c.** crater. **d.** sill.

3. Broad, gently sloping volcanoes with quiet eruptions are called
a. composite volcanoes. **b.** cinder cones. **c.** hot spots. **d.** shield volcanoes.

4. The most explosive volcanoes are
a. hot spots. **c.** cinder cones.
b. composite volcanoes. **d.** sheild volcanoes.

5. Most volcanoes form
a. at hot spots. **c.** in the middle of continents.
b. at plate boundaries. **d.** in the center of ocean plates.

6. Which of the following forms when the top or side of a volcano collapses into the magma chamber?
a. dike **c.** caldera
b. pyroclastic flow **d.** vent

7. ________ form(s) where plates move apart.
a. Hot sports **c.** Subuction zones
b. Divergent volcanism **d.** Convergent volcanism

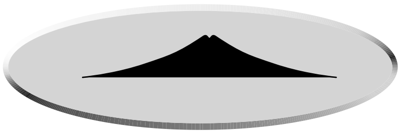
8. When magma reaches Earth's surface, it is called
a. a vent. **c.** lava.
b. a pyroclastic flow. **d.** calderas.

9. Volcanoes that form far from plate boundaries are associated with
a. subduction zones. **c.** ocean ridges.
b. divergent boundaries. **d.** hot spots.

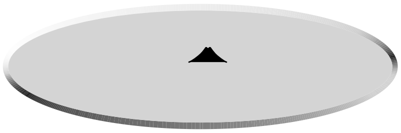
SECTION 18.1 *Volcanoes, continued*

In your textbook, read about types of volcanoes.
Label the diagrams as *composite volcano*, *cinder-cone volcano*, or *shield volcano*.

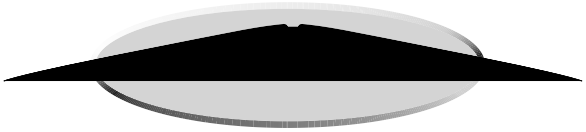
10. ______________________



11. ______________________



12. ______________________



Identify the type or types of volcano being described as *shield volcano*, *cinder-cone volcano*, or *composite volcano*.

______________ **13.** Forms when small pieces of magma are ejected into the air then fall back to Earth and pile up around a vent

______________ **14.** Has broad, gently sloping sides and a nearly circular base

______________ **15.** Forms when layers of basaltic lava accumulate during a nonexplosive eruption

______________ **16.** Mauna Kea in Hawaii is an example.

______________ **17.** Small volcano with steep sides

______________ **18.** Forms when layers of hardened lava chunks alternate with lava

______________ **19.** Forms from lava that contains relatively small amounts of gases and silica

______________ **20.** Forms from lava that is higher in water and silica content than lava that forms shield volcanoes
____

______________ **21.** Fueled by magma that contains large amounts of silica, water, and gases

______________ **22.** Magma that fuels this type of volcano contains large volumes of gases but not silica and water.

______________ **23.** Potentially the most dangerous to humans and most destructive to the environment

______________ **24.** Mount St. Helens and Mount Rainier are examples.

SECTION 18.1 *Volcanoes, continued*

In your textbook, read about where volcanoes occur.
Use each of the terms below just once to complete the passage.

Hawaiian Islands	**crust**	**divergent**	**hot spots**
Iceland	**mantle**	**volcanoes**	**ocean ridges**
Circum-Pacific Belt	**western**	**convergent**	

Most of the world's volcanoes form along **(25)** ____________________ plate boundaries. Slabs of oceanic crust descend into the **(26)** ____________________ and melt. The magma that forms is forced upward through the overlying plate and forms **(27)** ____________________ when it reaches Earth's surface. The **(28)** ____________________ marks the locations of most convergent boundary volcanoes. It stretches along the **(29)** ____________________ coasts of North and South America and down the eastern coast of Asia.

At **(30)** ____________________ plate boundaries, magma is forced upward into fractures and faults that form as plates separate or spread apart. Most of the volcanoes that form along divergent boundaries are located underwater along **(31)** ____________________. This type of volcanic activity can be observed above sea level in **(32)** ____________________, which sits atop the Mid-Atlantic Ridge.

Some volcanoes that form far from plate boundaries form over **(33)** ____________________, which are unusually hot regions of Earth's mantle. At hot spots, high-temperature plumes melt rock. The magma that forms moves upward toward the **(34)** ____________________ and melts the crust to form a volcano. As a tectonic plate moves over a hot spot, a string of volcanoes forms. The **(35)** ____________________ are forming as the result of a hot spot.

SECTION 18.2 *Eruptions*

In your textbook, read how magma forms.
For each statement below, write *true* or *false*.

______ **1.** Magma is a mixture of molten rock, suspended minerals, and gases.

______ **2.** Magma forms when rocks begin to melt.

______ **3.** Pressure decreases with depth below Earth's surface.

______ **4.** As pressure increases, the temperature at which a dry substance melts increases.

______ **5.** Wet minerals and rocks melt at lower temperatures than do dry minerals and rocks.

Answer the following questions.

6. What three factors affect the formation of magma?

______

7. Why isn't Earth's entire mantle liquid?

______

______

______

______

8. How does water affect the melting temperature of a mineral?

______

______

SECTION 18.2 *Eruptions, continued*

In your textbook, read about the types of magma.
Use each of the terms below just once to complete the passage.

andesitic	**continental**	**extrusive**	**granite**	**rhyolitic**
sediments	**silica**	**slowly**	**upper mantle**	**viscosity**

Magmas are named after **(9)** ____________________ rocks. Basaltic magma forms when rocks in the **(10)** ____________________ melt. This magma contains small amounts of silica and has a low **(11)** ____________________. Basaltic magma fuels relatively quiet volcanic eruptions.

Andesitic magma forms from oceanic crust and **(12)** ____________________. This magma contains about 60 percent silica and has an intermediate viscosity. **(13)** ____________________ magma fuels volcanoes with intermediate eruptions.

Rhyolitic magma forms deep beneath **(14)** ____________________ crust. This magma has the highest **(15)** ____________________ content of the three types of magma. It has the same composition as **(16)** ____________________, has a high viscosity, and flows **(17)** ____________________. **(18)** ____________________ magma produces very explosive volcanoes.

Answer the following questions.

19. How does the viscosity of magma change as magma cools?

____

20. Does cooler magma flow more or less quickly than hotter magma?

____

21. Is the viscosity of magma that is high in silica higher or lower than magma that is low in silica?

____

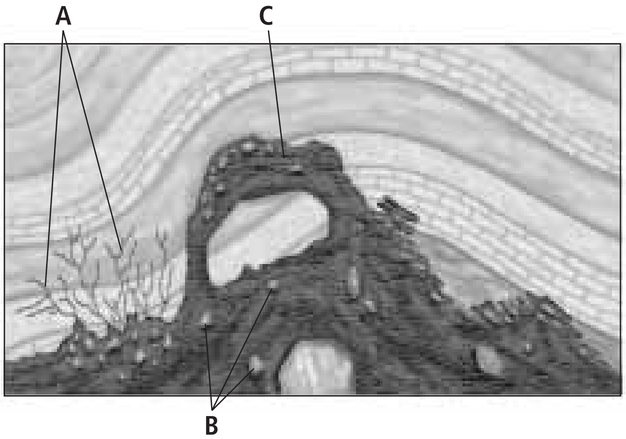
22. Which type of lava—basaltic lava or rhyolitic lava—flows faster? Explain.

____

____

SECTION 18.3 *Intrusive Activity*

In your textbook, read about how magma affects surrounding rocks.
Match each letter on the diagram with its description.



__________ **1.** Magma can melt rocks with which it comes into contact.

__________ **2.** Magma can fracture apart overlying rocks and rise through cracks and fissures.

__________ **3.** Magma can cause blocks of rocks to break off, sink into the magma, and eventually melt.

In your textbook, read about plutons and tectonics.
For each item in Column A, write the letter of the matching item in Column B.

	Column A	Column B
__________	**4.** Intrusive igneous rock body	**a.** stock
__________	**5.** Largest pluton	**b.** sill
__________	**6.** Irregularly shaped pluton that is similar to a batholith, but smaller in size	**c.** laccolith
__________	**7.** Mushroom-shaped pluton	**d.** pluton
__________	**8.** Pluton that is parallel to the rocks it intrudes	**e.** batholith
__________	**9.** Pluton that cuts across preexisting rocks	**f.** dike
__________	**10.** Process responsible for the formation of many plutons	**g.** mountain-building

Table of Contents

Chapter 19 Earthquakes

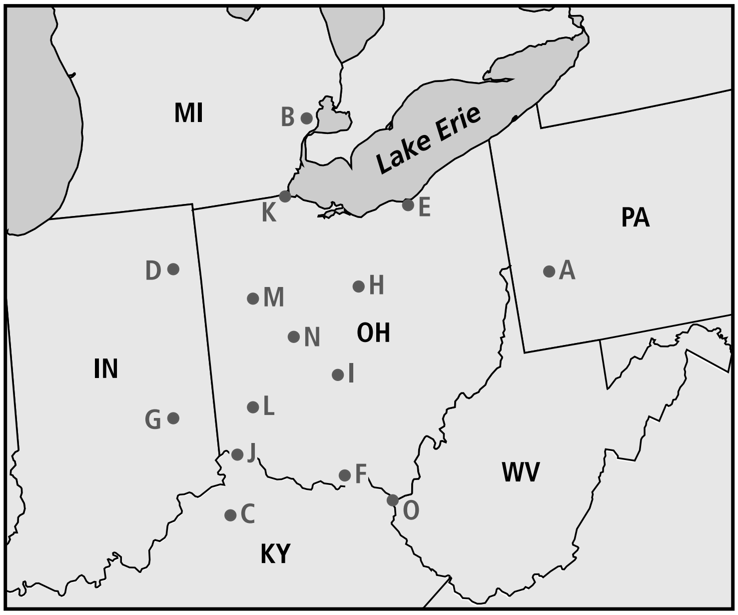
MiniLab 19 Make a Map

How is a seismic-intensity map made? Seismic-intensity data plotted on contour maps give scientists a visual picture of an epicenter's location and the earthquake's intensity.

Procedure

1. Read and complete the lab safety form.
2. Trace the map onto paper. Mark the locations indicated by the letters on the map.
3. Plot these Mercalli intensity values on the map next to the correct letter: A, I; B, III; C, II; D, III; E, IV; F, IV; G, IV; H, V; I, V; J, V; K, VI; L, VIII; M, VII; N, VIII; O, III.
4. Draw contours on the map to connect the intensity values.

Intensity Values of a Quake



Analyze and Conclude

1. **Determine** the maximum intensity value.

____

____

2. **Find** the location of the maximum intensity value.

____

____

3. **Estimate** the earthquake's epicenter?

____

____

Name Class Date

GeoLab Relate Epicenters and Plate Tectonics

The separation of P- and S-waves on a seismogram allows you to estimate the distance between the seismic station that recorded the data and the epicenter of that earthquake. If the epicentral distance from three or more seismic stations is known, then the exact location of the quake's epicenter can be determined.

PREPARATION

Question:

How do seismologists locate the epicenter of an earthquake?

Materials

U.S. map
Figure 17.16 and **Figure 19.9**
calculator
drafting compass
metric ruler

Objectives

In this GeoLab, you will:

- **Determine** the arrival times of P- and S-waves from a seismogram.
- **Interpret** travel-time curves.
- **Plot** an epicenter location on a map.
- **Relate** seismic data to plate tectonics.

GeoLab Data Table

Seismic Station	P-S Separation (min)	Epicenter Distance (km)	Map Distance (cm)
Berkeley, CA			
Boulder, CO			
Knoxville, TN			

PROCEDURE

Determine the epicenter location and the time of occurrence of an actual earthquake, using the travel times of P- and S-waves recorded at three seismic stations.

1. Read and complete the lab safety form.
2. The table gives data from three seismic stations. Use the travel-time curves in ***Figure 19.9*** and the P-S separation times to determine the distances from the epicenter to each seismic station. Enter these distances in the table under *Distance from Epicenter*.
3. Obtain a map of North America from your teacher. Accurately mark the three seismic station locations.
4. Use the map scale to determine the distance in cm represented by the *Distance from Epicenter* calculated in Step 2. Enter these distances in the table under *Map Distance*.
5. Use the number calculated in *Map Distance* to set the compass point to a spacing that represents the distance from the first seismic station to the epicenter.
6. Place the compass point on the seismic station location and draw a circle.
7. Repeat for the other two seismic stations.
8. Mark the point of intersection of the three circles. This is the epicenter of the earthquake.

Name Class Date

GeoLab Relate Epicenters and Plate Tectonics

Figure 17.16

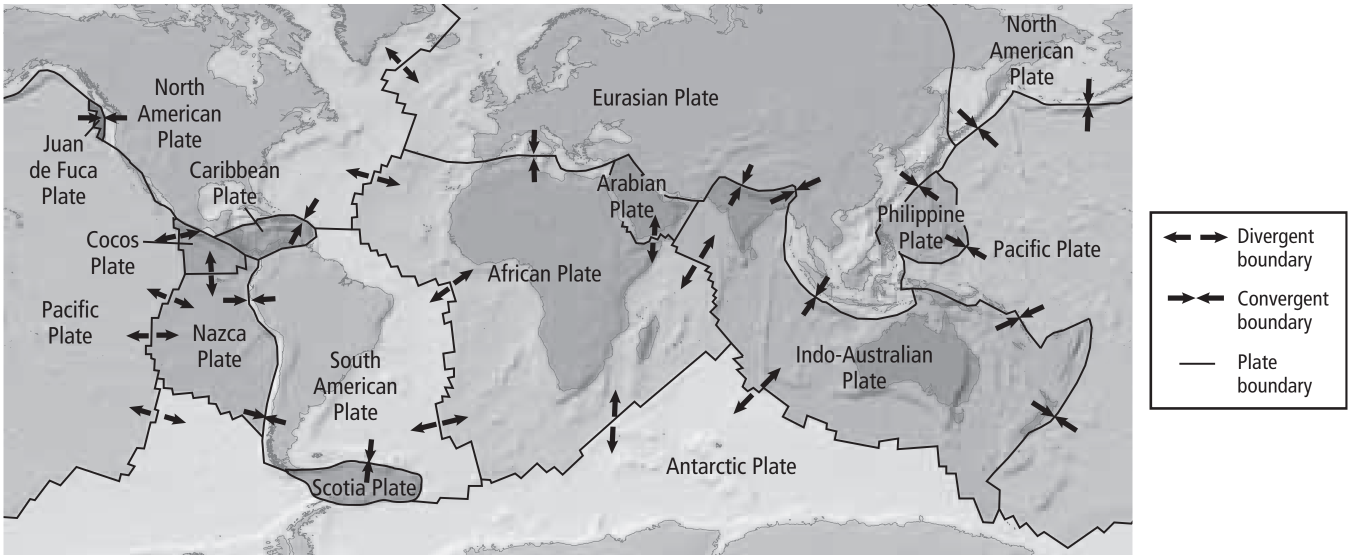
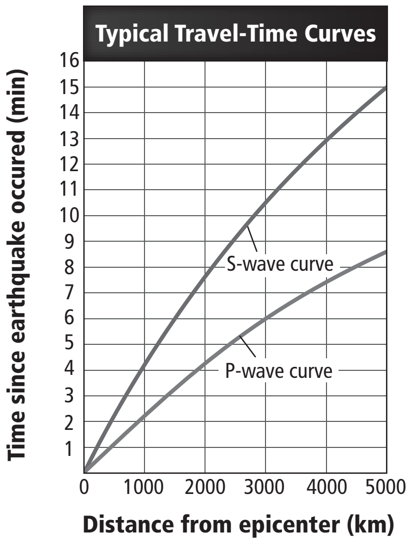


Figure 19.9



Name Class Date

GeoLab

Relate Epicenters and Plate Tectonics

ANALYZE AND CONCLUDE

1. **Interpret Data** Where is this epicenter located?

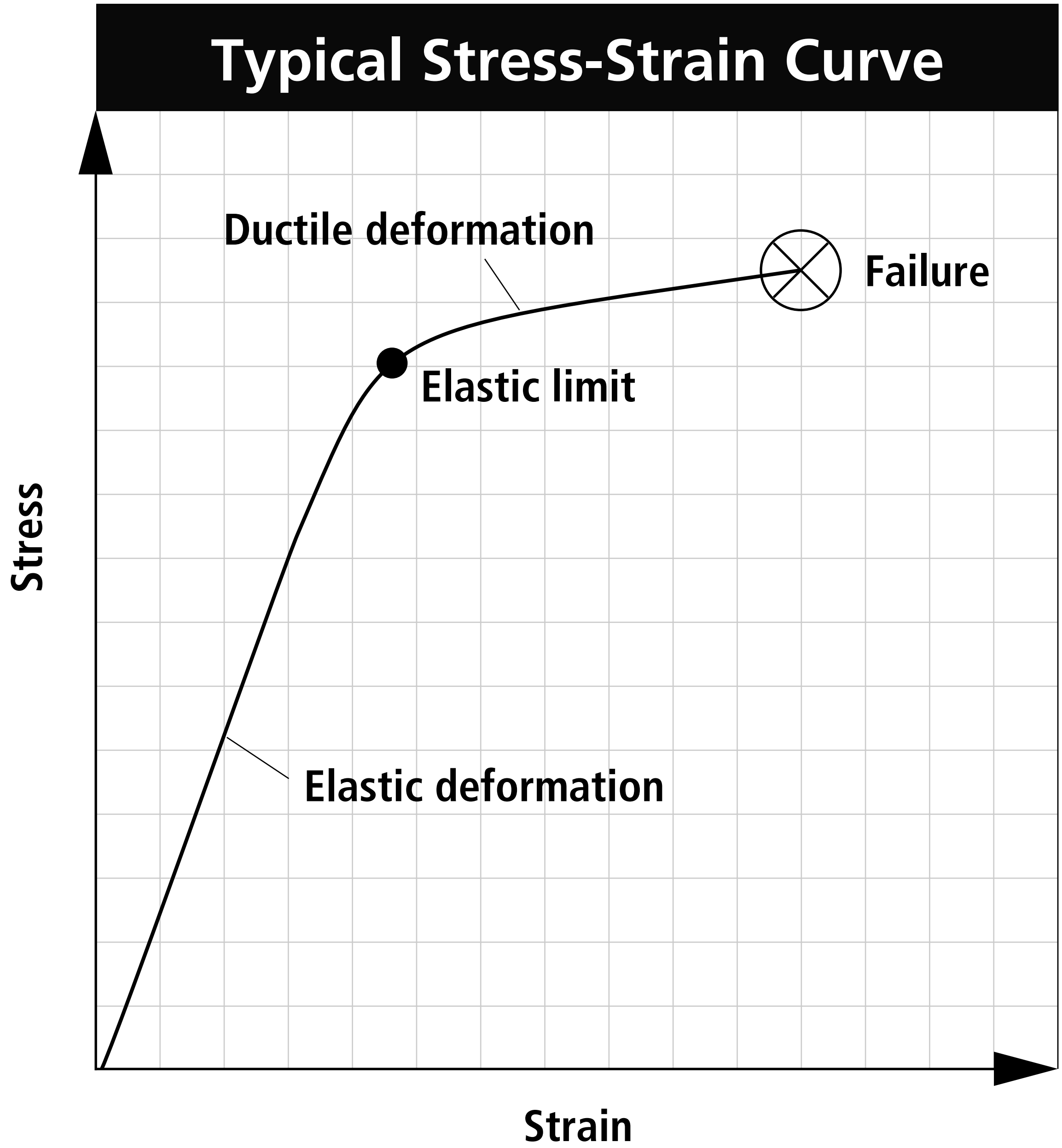
2. **Describe** In which major seismic belt did this earthquake occur?

3. **Interpret Data** Use ***Figure 17.16*** to determine which plates form the boundary associated with this earthquake.

4. **Conclude** Describe the tectonic motions that caused the earthquake.

Use with Chapter 19
Section 19.1

Stress–Strain Curve



Name Class Date

WORKSHEET 54 **TEACHING TRANSPARENCY**

Use with Chapter 19
Section 19.1

Stress–Strain Curve

1. What is stress?

____

2. What is strain?

____

3. According to the graph, how does strain respond to an increase in stress?

____

____

4. What part of the line represents the elastic deformation of the material?

____

5. How does elastic deformation affect a material? Is the effect reversible?

____

____

6. What part of the line represents ductile deformation of the material?

____

____

7. What happens to a material during ductile deformation?

____

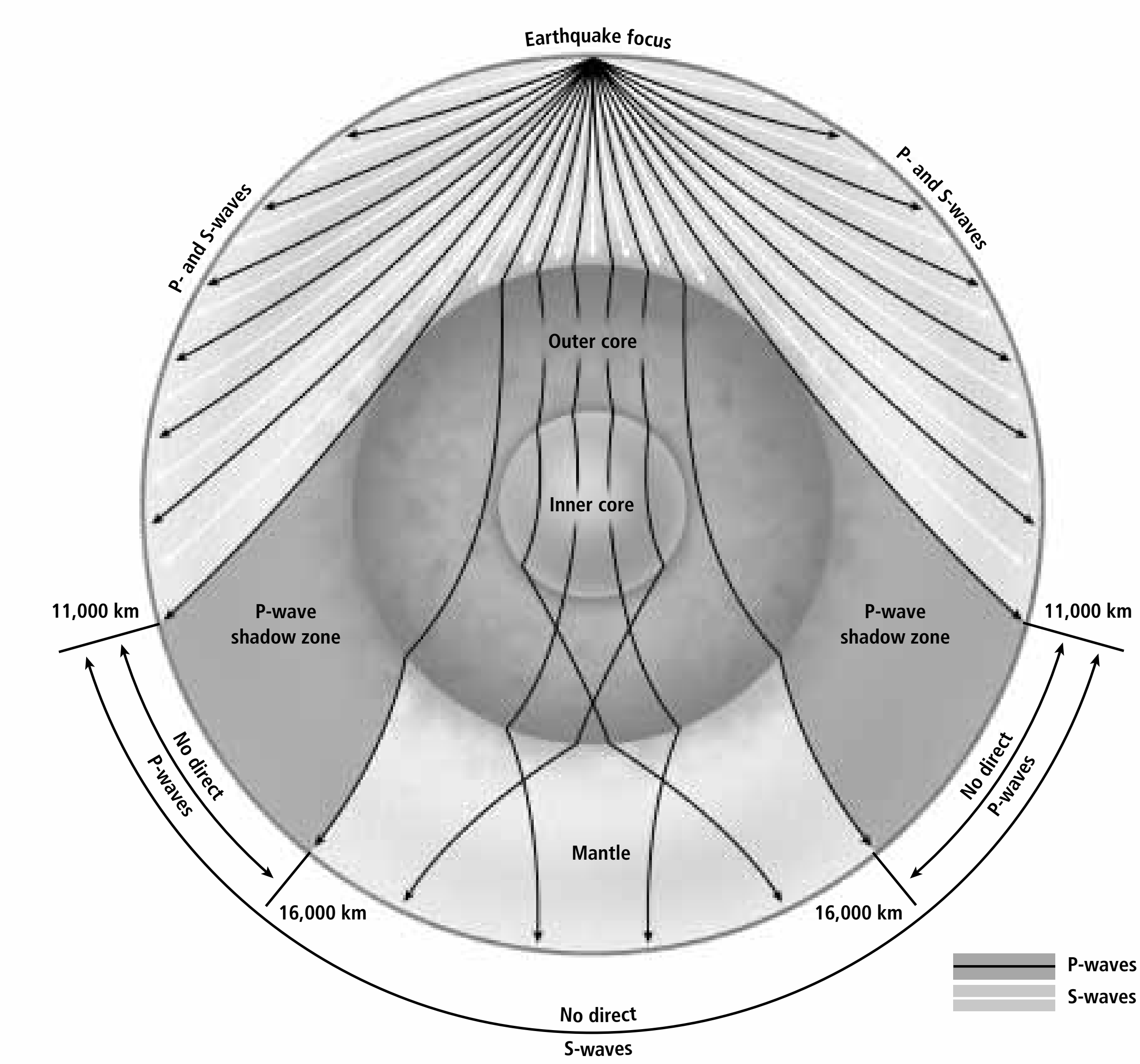
____

8. What happens when stress exceeds the strength of a material?

____

Use with Chapter 19
Section 19.2

Seismic Waves



Name Class Date

WORKSHEET 55 **TEACHING TRANSPARENCY**

Use with Chapter 19
Section 19.2

Seismic Waves

1. What are the three types of seismic waves produced during an earthquake?

2. Describe how the different types of seismic waves affect the rocks through which they travel.

3. What type of wave is shown traveling through the core? Explain why this is the only wave type shown in the core.

4. What happens to P-waves when they strike the inner core?

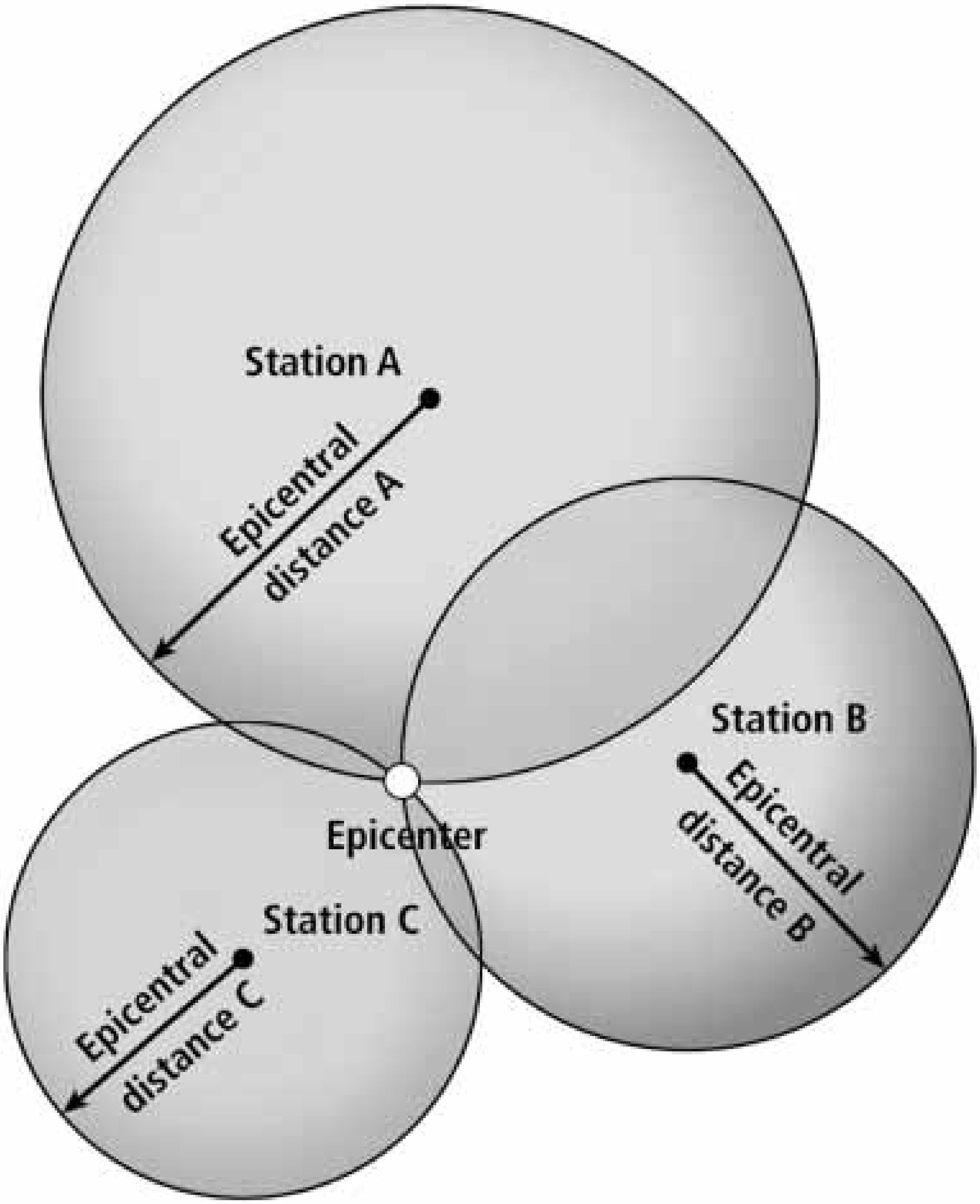
5. What is the P-wave shadow zone?

6. Why have scientists reasoned that Earth's outer core is liquid?

7. How have scientists inferred the composition of Earth's interior?

Use with Chapter 19
Section 19.3

Locating Earthquakes



Name Class Date

WORKSHEET 56 **TEACHING TRANSPARENCY**

Use with Chapter 19
Section 19.3

Locating Earthquakes

1. What is an earthquake's epicenter?

2. What does each circle in the diagram represent?

3. What is an epicentral distance?

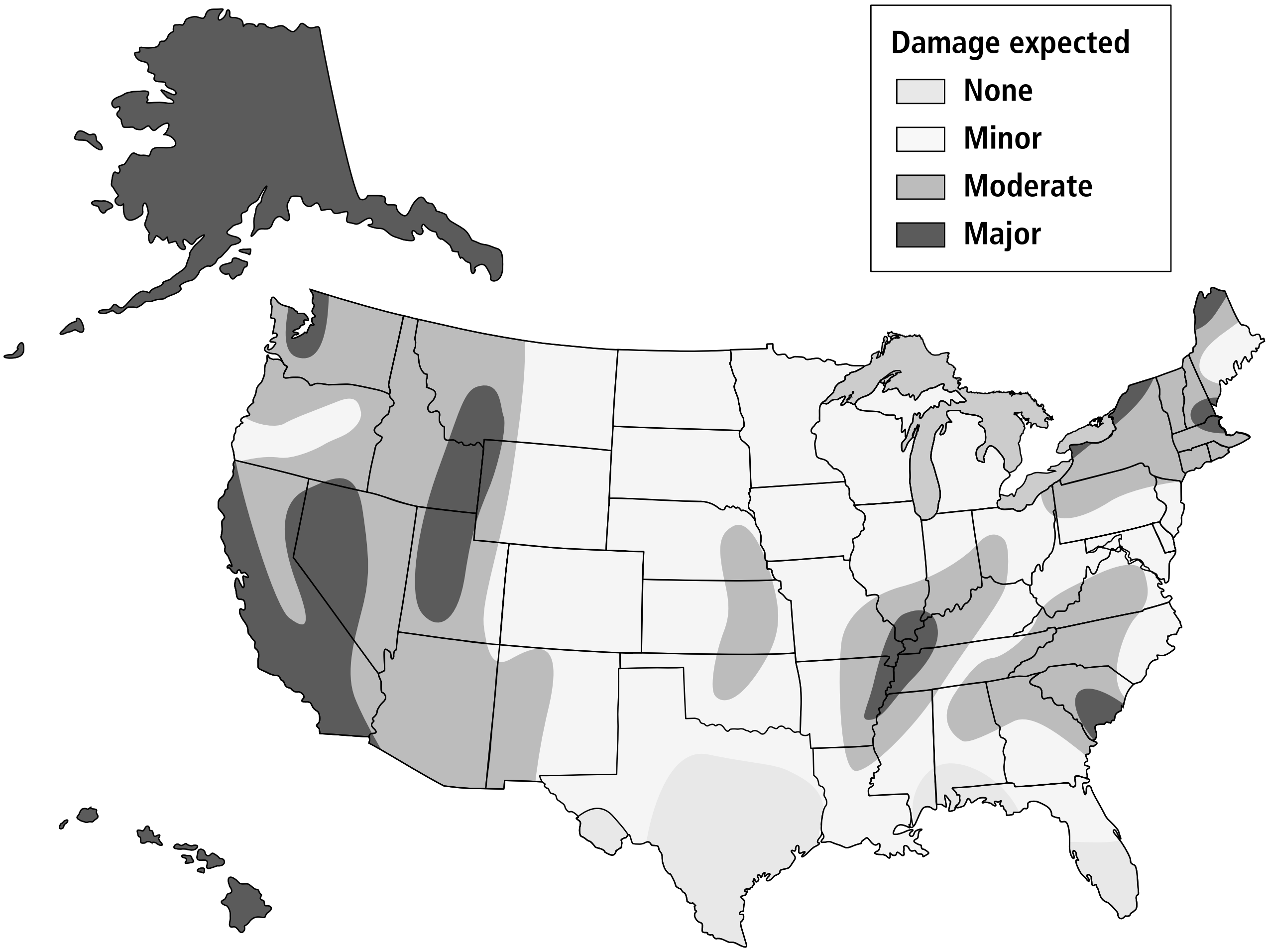
4. How is an epicentral distance determined?

5. How many epicentral distances must be determined to locate an earthquake's epicenter?

6. How many possible locations of an epicenter can be determined from two epicentral distances? Explain your answer.

Use with Chapter 19
Section 19.4

Seismic Risk Map of the United States



Name Class Date

WORKSHEET 57 TEACHING TRANSPARENCY

Use with Chapter 19
Section 19.4

Seismic Risk Map of the United States

1. Make a general statement summarizing what the map shows.

2. What regions have the highest risk of major damage from an earthquake?

3. What is the level of damage expected as a result of earthquake activity in southern Florida?

4. Name two states where only minor damage as a result of earthquake activity is expected.

5. Does this map show the probability of an earthquake occurring in a region in a given period of time? Why or why not?

6. How is the seismic risk of an area estimated? What are the characteristics of regions that have the highest seismic risk?

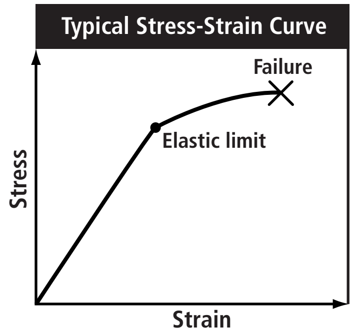
7. What is a seismic gap?

Name Class Date

Earthquakes

SECTION 19.1 *Forces Within Earth*

In your textbook, read about the effects of stress and strain on rocks.
Answer the following questions.



1. What is stress?

____

2. What is strain?

____

3. What is compression?

____

4. What is tension?

____

Use the graph to answer questions 5–7.

5. What happens when stress exceeds the strength of a material?

____

6. On the stress-strain curve, what part of the curve represents the elastic deformation of a material? What part represents plastic deformation?

____

____

7. Which occurs at a lower stress value, plastic deformation or elastic deformation?

____

8. Are rocks near Earth's surface generally brittle or plastic? Rocks at great depths?

____

SECTION 19.1 *Forces Within Earth, continued*

In your textbook, read about the different types of faults.
For each item in Column A, write the letter of the matching item in Column B.

Column A		Column B
______	**9.** Fracture that forms as a result of horizontal compression	**a.** fault
______	**10.** Fracture caused by horizontal shear	**b.** fault plane
______	**11.** Famous California strike-slip fault	**c.** normal fault
______	**12.** Fracture caused by horizontal tension	**d.** reverse fault
______	**13.** Fracture along which movement occurs	**e.** San Andreas
______	**14.** Fault surface along which movement takes place	**f.** strike-slip fault

In your textbook, read about the different kinds of seismic waves.
Complete the table by filling in the type or types of seismic waves described.

Seismic Waves

Description	Type of Seismic Wave
15. Causes rock to move both up and down and from side to side	
16. Causes rock to move at right angles to the direction in which the wave travels	
17. Squeezes and pulls rock in the same direction as the wave travels	
18. Can pass through Earth's interior	
19. Travels only along Earth's surface	

Name ______________________________ Class __________ Date __________

CHAPTER 19 STUDY GUIDE

SECTION 19.2 *Seismic Waves and Earth's Interior*

In your textbook, read about seismometers and clues to Earth's interior.

Use each of the terms below to complete the following statements.

mass **seismometer** **seismogram** **frame**

1. A ____________________ is an instrument that records earthquake vibrations.

2. All seismometers include a ____________________ suspended from a wire or spring.

3. A paper or computer record of earthquake vibrations is called a ____________________.

4. All seismometers include a ____________________ that is anchored to the ground and vibrates during an earthquake.

For each statement below, write *true* or *false*.

________________ **5.** Seismic waves change speed and direction when they encounter different materials.

________________ **6.** P-waves travel through Earth's mantle.

________________ **7.** S-waves do not travel through Earth's mantle.

________________ **8.** Surface waves are the first to arrive at a seismic facility.

________________ **9.** P-waves are bent when they strike the core.

________________ **10.** On seismograms, seismic waves recorded from more distant facilities are closer together than those recorded from facilities close to the epicenter.

________________ **11**. S-waves do not enter the core because they cannot travel through solids.

________________ **12.** Seismologists have reasoned that Earth's outer core must be liquid based on the disappearance of S-waves.

________________ **13.** Studies of how waves reflect deep inside Earth show that Earth's inner core is solid.

________________ **14.** The P-wave shadow zone does not receive direct P-waves.

SECTION 19.3 *Measuring and Locating Earthquakes*

In your textbook, read about earthquake magnitude and intensity.
Circle the letter of the choice that best completes the statement.

1. The amount of energy released by an earthquake is measured by its
a. amplitude. **b.** magnitude. **c.** focus. **d.** intensity.

2. The Richter scale is a numerical scale used to describe an earthquake's
a. intensity. **b.** amplitude. **c.** probability. **d.** magnitude.

3. Each whole-number increase on the Richter scale corresponds to a 32-fold increase in
a. seismic energy. **b.** magnitude. **c.** probability. **d.** intensity.

4. The moment magnitude scale takes into account the size of an earthquake's
a. epicenter. **b.** fault rupture. **c.** probability. **d.** intensity.

5. The time an earthquake occurred can be estimated from the
a. P-wave arrival time. **c.** surface wave arrival time.
b. amplitude. **d.** seismic wave size.

6. The amount of damage done to structures by an earthquake is the earthquake's
a. intensity. **b.** amplitude. **c.** probability. **d.** seismic gap.

7. The modified-Mercalli scale measures an earthquake's
a. intensity. **b.** seismic gap. **c.** probability. **d.** magnitude.

8. The modified-Mercalli scale ranges from
a. 0 to 100. **b.** 1 to 10. **c.** I to XII. **d.** VI to XXI.

9. Earthquake intensity depends primarily on the height of
a. P-waves. **b.** S-waves. **c.** surface waves. **d.** the fault.

10. As the distance from a quake's epicenter increases,
a. intensity increases. **c.** magnitude increases.
b. intensity decreases. **d.** the focus decreases.

11. Maximum earthquake intensity is usually found at the earthquake's
a. epicenter. **c.** seismic gap.
b. shadow zone. **d.** focus.

12. One factor that determines the strength of an earthquake is the depth of its
a. epicenter. **c.** magnitude.
b. epicentral distance. **d.** focus.

13. The focus of a catastrophic earthquake with high intensity values is almost always
a. deep. **c.** difficult to determine.
b. shallow. **d.** below the point of initial rock failure.

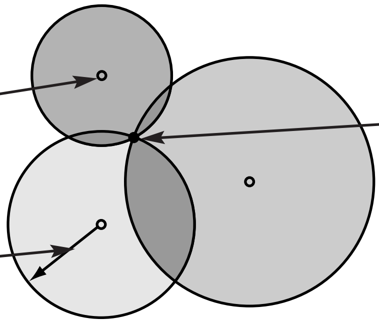
SECTION 19.3 *Measuring and Locating Earthquakes,* *continued*

In your textbook, read about how scientists locate an earthquake's epicenter.

Label the diagram below. Choose from the following: *epicenter, epicentral distance, seismic station.*

14. ____________________

15. ____________________



16. ____________________

Answer the following questions.

17. To determine an epicentral distance, scientists consider the arrival times of what wave types?

____

18. Can the location of an epicenter be determined from the distance between one seismic station and the epicenter? If not, what information is needed?

____

____

In your textbook, read about Earth's seismic belts.

Use each of the terms below just once to complete the passage.

Circum-Pacific Belt	**boundaries**	**tectonic plates**
Mediterranean-Asian Belt	**ocean ridges**	**seismic belts**

Most earthquakes occur in narrow **(19)** ____________________ that lie between large regions with little or no seismic activity. Seismic activity in seismic belts is a result of movements among Earth's **(20)** ____________________. Most earthquakes occur near the **(21)** ____________________ of tectonic plates. Nearly 80 percent of earthquakes occur in the seismic belt known as the **(22)** ____________________. About 15 percent of all earthquakes occur in the **(23)** ____________________, which stretches across Europe and Asia. Most other earthquakes occur on the crests of **(24)** ____________________.

Name Class Date

CHAPTER 19 STUDY GUIDE

SECTION 19.4 *Earthquakes and Society*

In your textbook, read about how earthquakes are predicted and the factors that affect how damaging an earthquake is.
Answer the following questions.

1. What kinds of structures suffer the most severe damage from an earthquake?

2. How would a rubber structure beneath a building prevent it from being damaged?

3. What takes place during the process called “pancaking”?

4. How is the height of a building related to damage caused during an earthquake?

5. What can happen during earthquakes in areas where the ground contains fluid-saturated sand?

6. How are seismic waves changed as they pass through soft soils?

7. What can occur on a steep slope during an earthquake?

8. Is an area that has already experienced past earthquakes more or less likely to experience a future earthquake than an area that has never had an earthquake?

9. Upon what two factors is the probability of earthquake occurrence based?

10. What is a seismic gap?

Table of Contents

Reproducible Pages

Chapter 20 Mountain Building

MiniLab 20

Model Isostatic Rebound

How can isotatic rebound be measured? Isostatic rebound is the process through which the underlying material rises when the overlying mass is removed.

Procedure

1. Read and complete the lab safety form.
2. Working in groups, fill a 1000-mL beaker with corn syrup.
3. Using a pencil, push a paper or plastic cup down into the syrup far enough so that about three-fourths of the cup (open side up) is below the top of the syrup. Record the depth of the bottom of the cup relative to the surface, then let go of the cup.
3. At 5 s intervals, record the new depth of the bottom of the cup.

Analyze and Conclude

1. **Describe** In which direction did the cup move? Why?

____

____

2. **Explain** why the speed or the cup changes as it moves.

____

____

____

____

3. **Infer** If enough time passes, the cup stops moving. Why?

____

____

____

____

____

____

____

Mapping GeoLab

Make a Map Profile

A map profile, which is also called a topographic profile, is a side view of a geographic or geologic feature constructed from a topographic map. You will construct and analyze a profile of the Grand Tetons, a mountain range in Wyoming that formed when enormous blocks of rocks were faulted along their eastern flanks, causing the blocks to tilt to the west.

PREPARATION

Question

How do you construct a map profile?

Safety Procedures

Materials

metric ruler
sharp pencil
graph paper

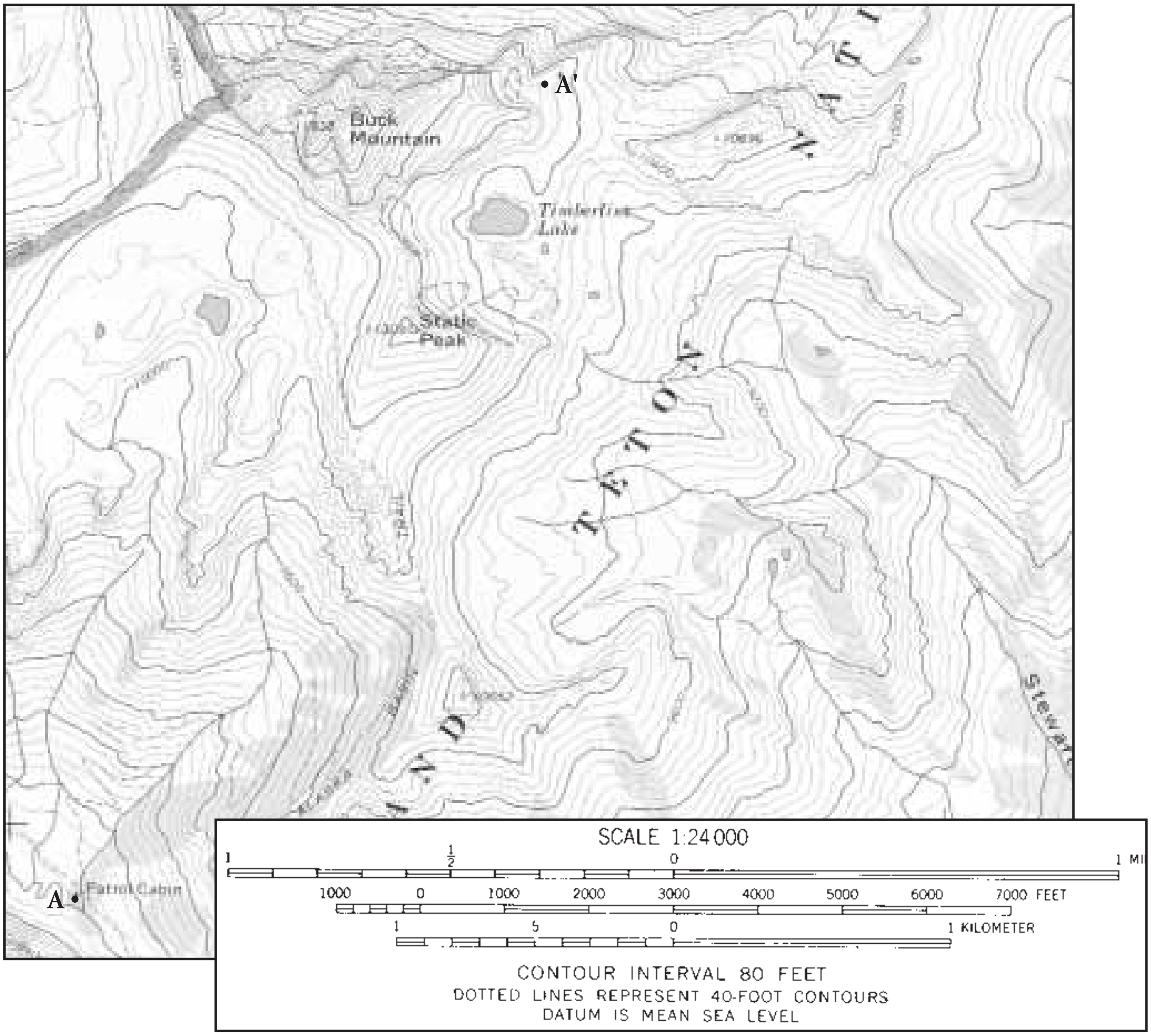
PROCEDURE

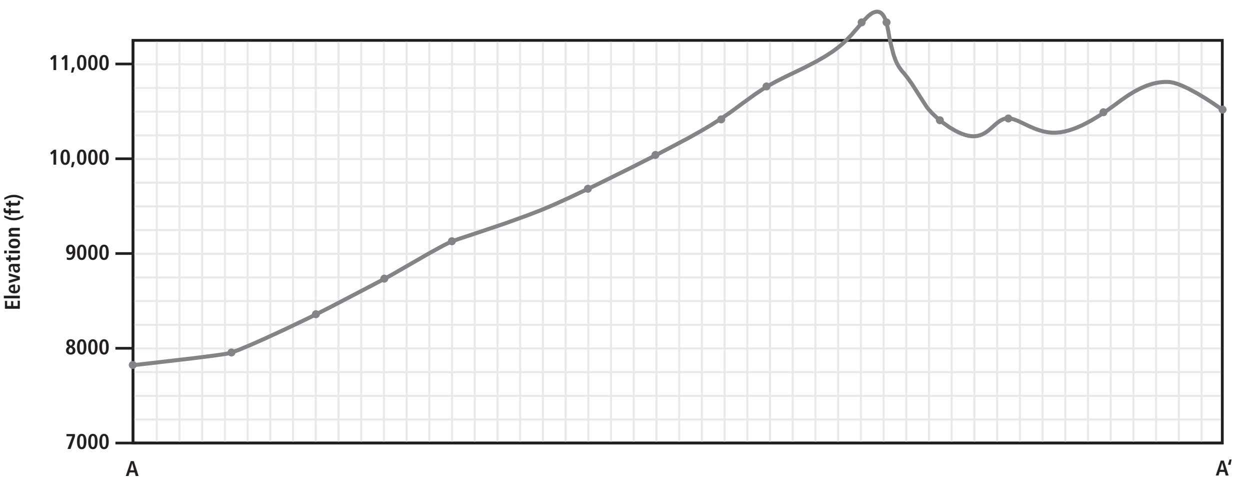
Contour lines are lines on a map that connect points of equal elevation. Locate the index contour lines on the map on the next page. Index contour lines are the ones in a darker color.

1. Read and complete the lab safety form.
2. On the graph paper, make a grid like the one shown on the facing page.
3. Place the edge of a paper strip along the profile line AA' and mark where each major contour line intersects the strip.
4. Label each intersection point with the correct elevation.
5. Transfer the points from the paper strip to the profile grid.
6. Connect the points with a smooth line to construct a profile of the mountain range along line AA'.
7. Label the major geographic features on your profile.

Name Class Date

Mapping GeoLab Making a Map Profile





Name Class Date

Mapping GeoLab

Make a Map Profile

ANALYZE AND CONCLUDE

1. **Interpret Data** Describe how the topographic profile changes with distance from point A.

2. **Interpret Data** What is the elevation of the highest point on the topographic profile? The lowest point?

3. **Interpret Data** What is the average elevation shown in the profile?

4. **Interpret Data** Calculate the total relief shown in the profile.

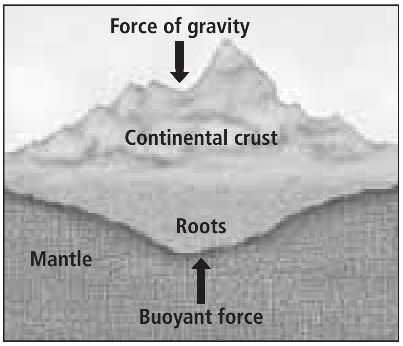
5. **Interpret Data** Is your topographic profile an accurate model of the topography along line AA'? Explain.

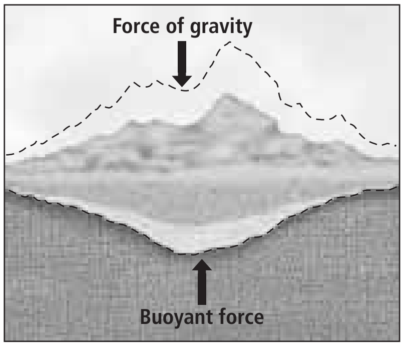
6. **Analyze** What determined the scale of this topographic profile?

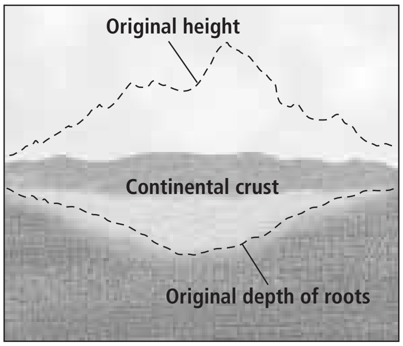
7. **Predict** What would happen to your topographic profile if the horizontal scale was marked in 20-ft intervals?

Use with Chapter 20
Section 20.1

Isostatic Rebound







Name Class Date

WORKSHEET 58 TEACHING TRANSPARENCY

Use with Chapter 20
Section 20.1

Isostatic Rebound

1. What force pushes upward on the continental crust? What force pushes downward?

2. How does the mass of the mountain change in this series of diagrams, and what causes the change?

3. How does the mountain's root change, and why?

4. How do the density and thickness of continental and oceanic crust affect the way each displaces the mantle?

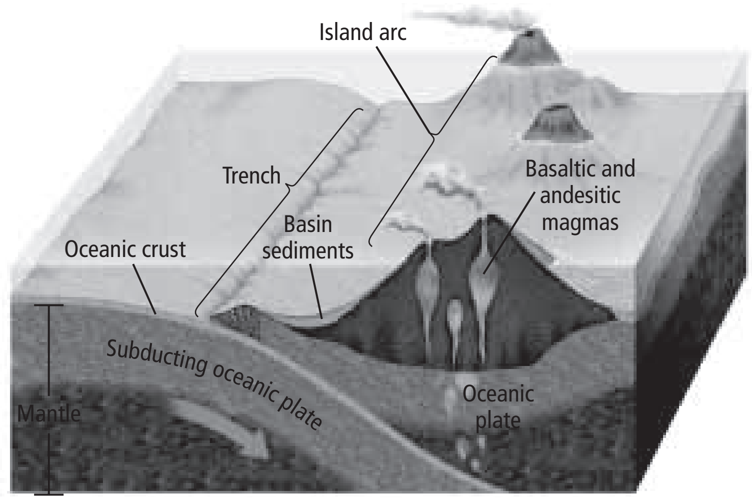
5. Describe the relationship between the forces on Earth's crust when isostasy occurs.

6. Describe what would happen if crust was added to a mountain as the result of volcanic activity.

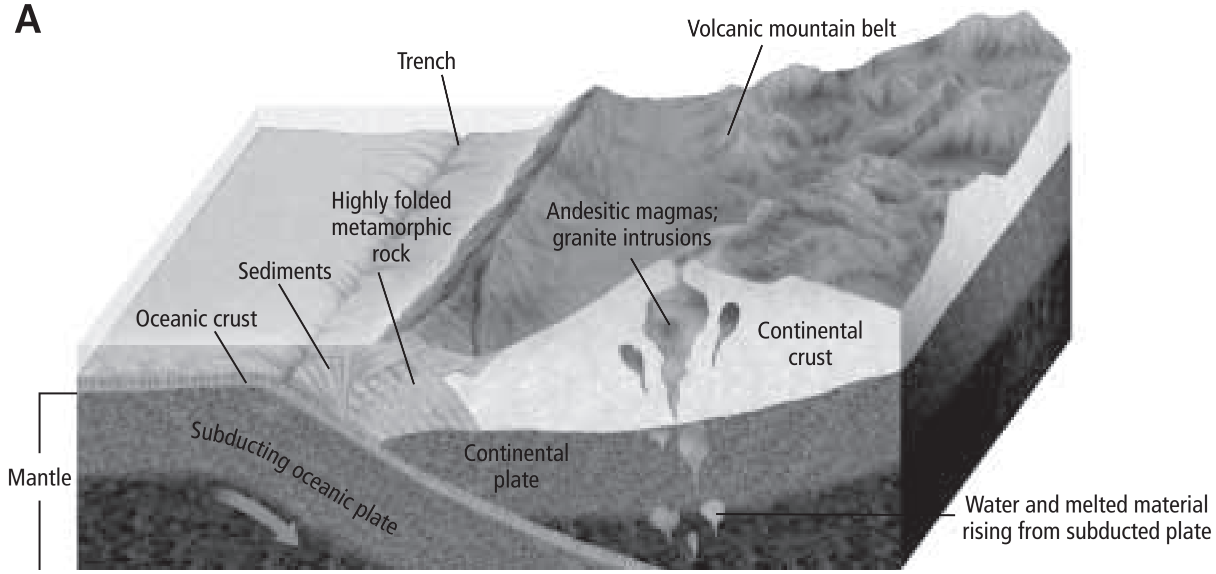
7. Name and define the process shown in the diagrams.

Use with Chapter 20
Section 20.2

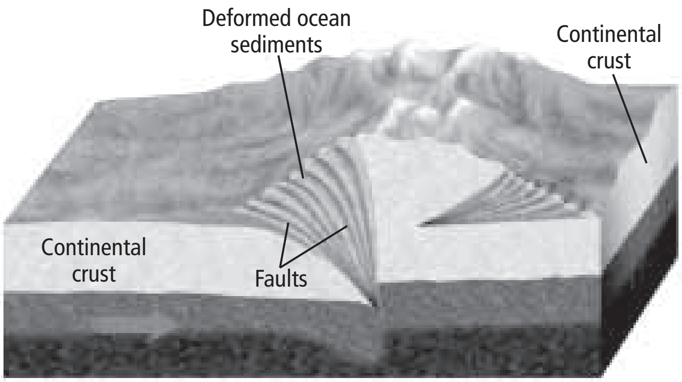
Convergent-Boundary Mountains



A



B



C

Name Class Date

WORKSHEET 59 TEACHING TRANSPARENCY

Use with Chapter 20
Section 20.2

Convergent-Boundary Mountains

1. What process is common to all three diagrams?

2. Compare and contrast diagrams A and B.

3. What types of rocks make up each of the mountains shown?

4. How does magma contribute to mountain building in diagram A?

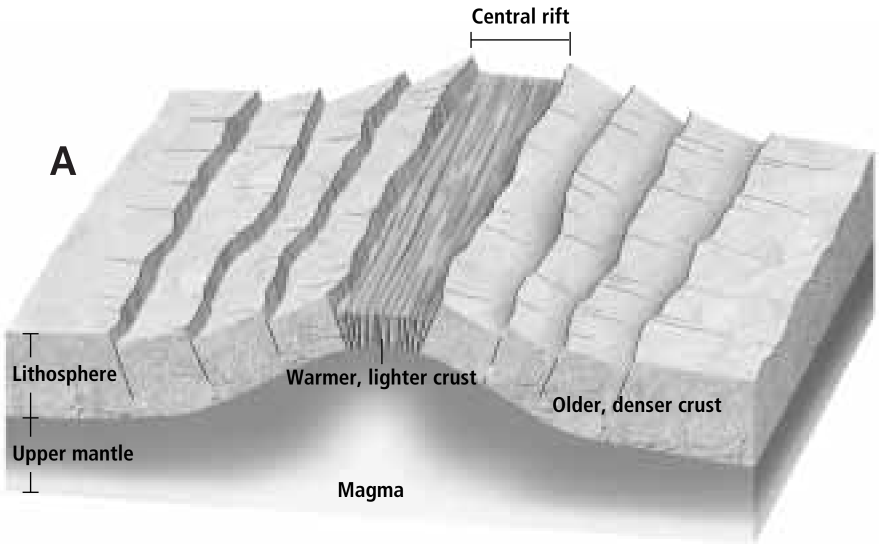
5. How does magma contribute to mountain building in diagram B?

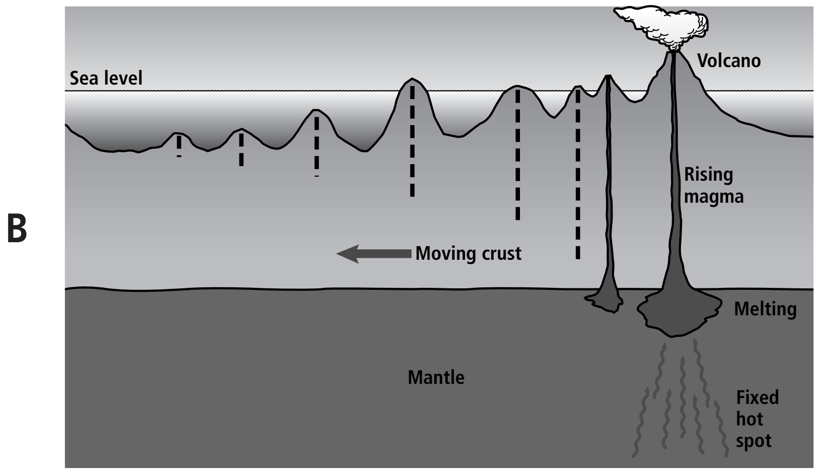
6. Which type of boundary results in the formation of Earth's highest mountains? Why?

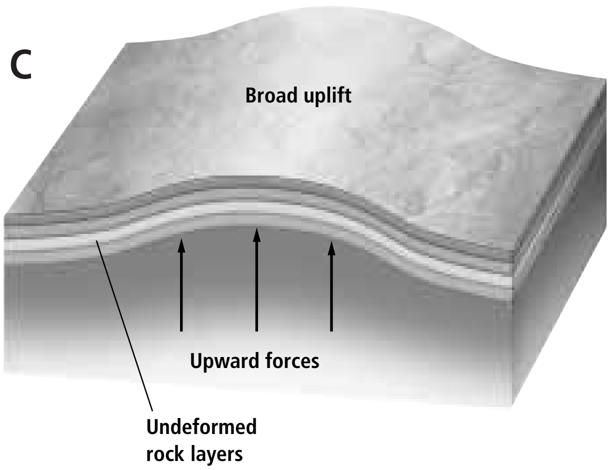
7. What features are unique to the mountains in diagram C?
How do these features form?

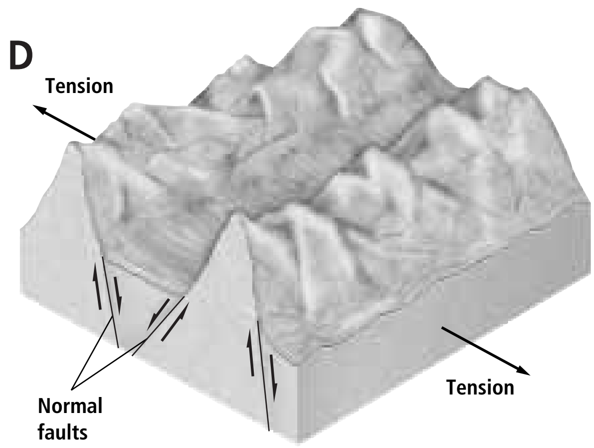
Use with Chapter 20
Section 20.3

Nonboundary Mountains









WORKSHEET 60 TEACHING TRANSPARENCY

Use with Chapter 20
Section 20.3

Nonboundary Mountains

1. In terms of tectonics, how do the settings in diagrams B–D differ from the setting in diagram A?

2. Describe the mountain that forms in the setting shown in diagram A.

3. In diagram B, what is the feature over which mountains form called?

4. What geologic process is common to the formation of mountains in diagrams A and B?

5. Compare and contrast the formation of the mountains shown in diagrams C and D.

6. Name an example of the type of mountains shown in diagram D.

7. The Adirondack Mountains are examples of which of the mountains shown?

Name Class Date

CHAPTER 20 STUDY GUIDE FOR CONTENT MASTERY

Mountain Building

SECTION 20.1 *Crust–Mantle Relationships*

In your textbook, read about Earth's topography and the relationships between the crust and the mantle.

Circle the letter of the choice that best completes the statement or answers the question.

1. Approximately how much of Earth's surface is below sea level?
a. 10 percent **b.** 30 percent **c.** 70 percent **d.** 90 percent

2. Approximately how much of Earth's surface is above sea level?
a. 10 percent **b.** 30 percent **c.** 70 percent **d.** 90 percent

3. The largest percentage of Earth's surface above sea level ranges in elevation from 0 km to
a. 0.5 km. **b.** 0.8 km. **c.** 1 km. **d.** 2 km.

4. How far below sea level is the largest percentage of Earth's surface?
a. 0–1 km **b.** 1–2 km **c.** 3–4 km **d.** 4–5 km

5. Oceanic crust is made of
a. basalt and is denser than continental crust.
b. granite and is denser than continental crust.
c. basalt and is less dense than continental crust.
d. granite and is less dense than continental crust.

In your textbook, read about isostasy and erosion.

Use each of the terms below just once to complete the passage.

equilibrium **isostatic rebound** **mantle** **mountains** **roots** **seamounts** **smaller**

Isostasy is a condition of **(6)** ____________________ between the mass of Earth's crust and the buoyancy of the mantle. Topographic highs in the crust have deep **(7)** ____________________ that extend into the mantle and provide buoyant support. Continents are said to float on the denser **(8)** ____________________.

As **(9)** ____________________ rise, deep roots form. As mountains are eroded, their roots become **(10)** ____________________. As material is removed from mountains by erosion, the crust slowly rises. This process is known as **(11)** ____________________. Such crustal movements resulting from isostasy are not restricted to continents, but also occur when volcanic mountains on the seafloor, called **(12)** ____________________, form.

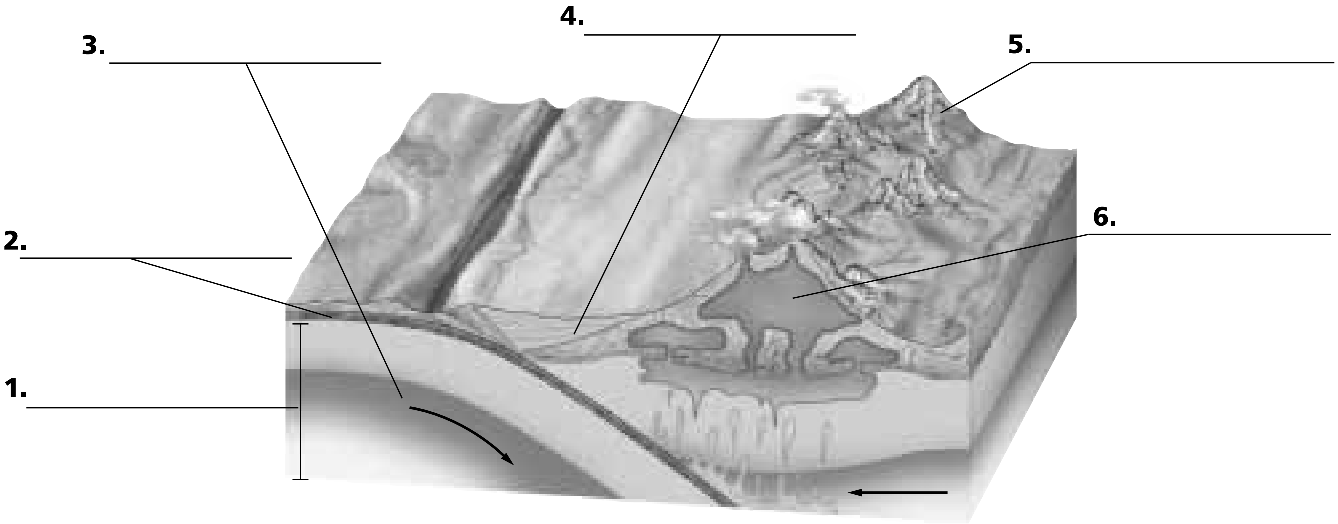
Name ______________________ Class __________ Date __________

SECTION 20.2 *Orogeny*

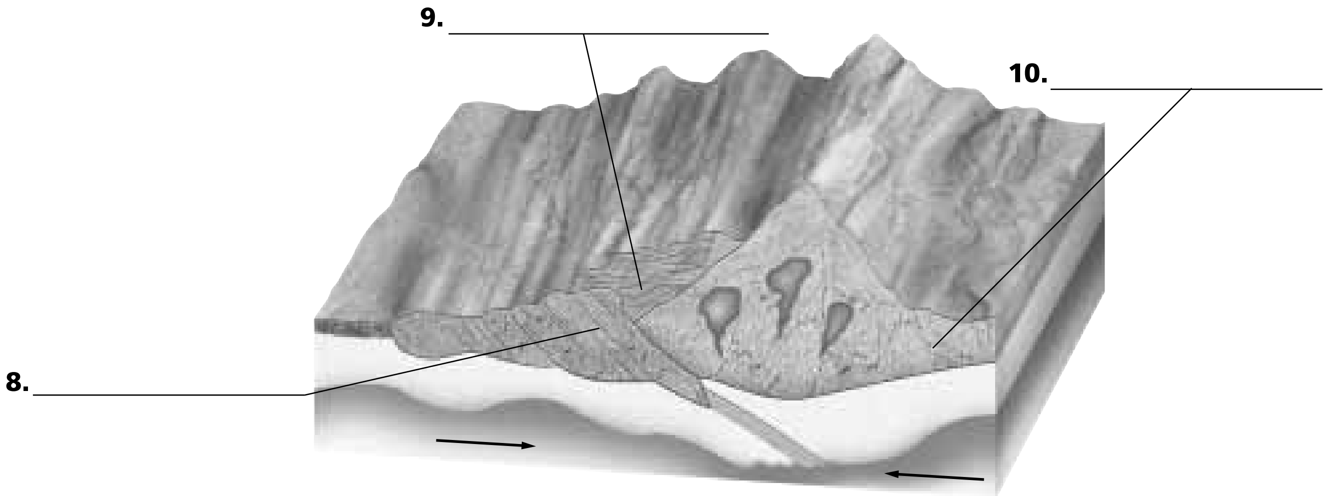
In your textbook, read about mountains that form as the result of convergence.

Use the terms below to label the diagrams. On the line below each diagram, write the name of the type of boundary pictured.

continental crust	**deformed sediments**	**fault**	**basin sediments**	
island arc complex	**magma**	**mantle**	**oceanic crust**	**subducting plate**



7. ______________________________

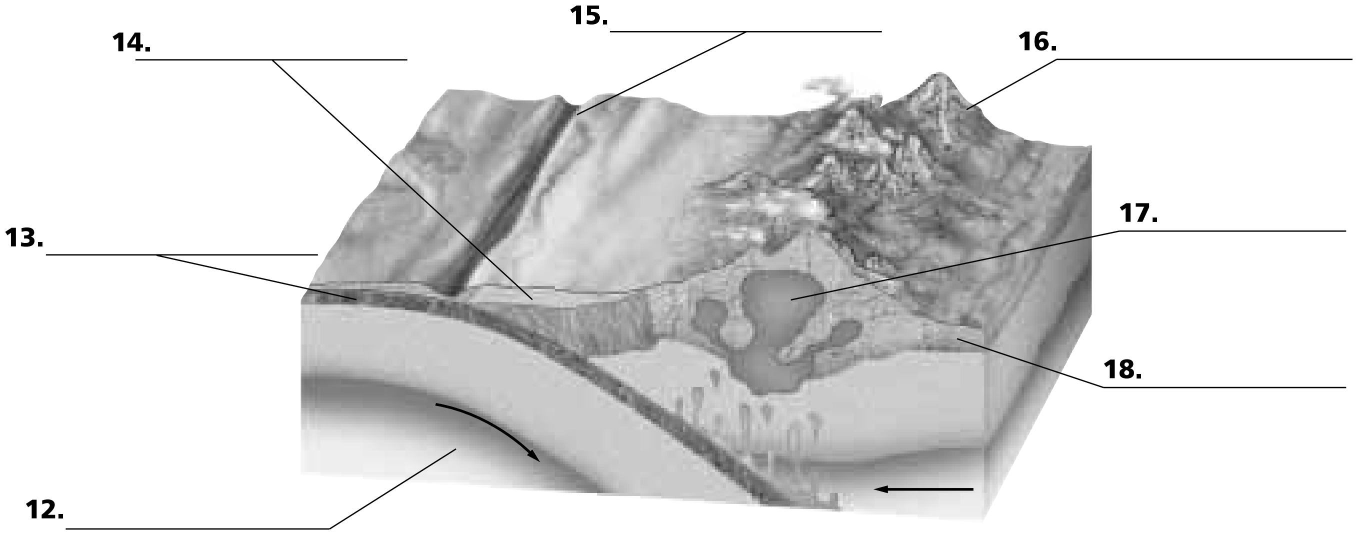


11. ______________________________

SECTION 20.2 *Orogeny, continued*

Use the terms below to label the diagram. On the line below the diagram, write the name of the type of boundary pictured.

continental crust	**trench**	**magma**	**oceanic crust**
sediments	**subducting plate**	**volcanic mountains**	



19. ______

SECTION 20.2 *Orogeny, continued*

Answer the following questions.

20. Which convergent plate boundary does not include a subduction zone? Why?

21. How can oceanic sediments become part of continental mountains?

22. How do the mountains that form along an oceanic-oceanic convergent boundary differ from those associated with an oceanic-continental convergent boundary?

23. What happens when a continental plate converges with another continental plate?

24. Briefly describe the events that led to the formation of the Appalachian Mountains.

SECTION 20.3 *Other Types of Mountain Building*

In your textbook, read about divergent–boundary and nonboundary mountains.

For each item in Column A, write the letter of the matching item in Column B.

	Column A		Column B
______	**1.** Region of very broad uplift at a divergent plate boundary on the ocean floor	**a.**	Adirondack Mountains
______	**2.** Example of divergent-boundary mountains	**b.**	Basin and Range Province
______	**3.** Forms when a large region of Earth's crust is uplifted as a unit	**c.**	fault-block mountain
______	**4.** Example of uplifted mountains	**d.**	plateau
______	**5.** Forms when large pieces of crust are tilted, uplifted, or dropped between large faults	**e.**	ocean ridge
______	**6.** Example of fault-block mountains	**f.**	mid-Atlantic Ridge
______	**7.** Length of underwater volcanic mountains	**g.**	uplifted mountain
______	**8.** Large, flat-topped, uplifted area	**h.**	65,000 km

Answer the following questions.

9. What causes regional uplift?

____

____

____

____

10. What is a plateau?

____

____

____

____

Name Class Date

SECTION 20.3 *Other Types of Mountain Building, continued*

In your textbook, read about nonboundary mountains.
Answer the following questions.

11. What makes uplifted mountains and fault-block mountains different from other mountains?

____

____

12. Describe the rocks that make up uplifted mountains. How are these rocks different from rocks associated with plate-boundary orogeny?

____

____

____

____

13. Describe how fault-block mountains form.

____

____

____

14. Describe and classify the mountains of the Basin and Range Province.

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